

**U.S. Army Corps  
of Engineers**  
New England District  
Concord, Massachusetts

**SUPPLEMENTAL DESIGN INFORMATION  
FOR THE PHASE 1/PHASE 2 TRANSITION  
AREA OF THE 1.5-MILE REACH REMOVAL  
ACTION**

DCN: GE-062703-ABRG

June 27, 2003

**Site-Specific Environmental Remediation Contract  
General Electric (GE)/Housatonic River Project  
Pittsfield, Massachusetts**

Contract No. DACW33-00-D-0006

Task Order No. 0005

GE-062703-ABRG

**United States Environmental Protection Agency  
EPA New England  
One Congress Street, Suite 1100  
Boston, MA 02114-2023**

June 27, 2003

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Public Information Repositories

**RE: Transmittal of the Final Plans, Specifications, and Supplemental Design  
Information for the Phase 1/Phase 2 Transition Area  
1.5 Mile Reach Removal Action  
GE-Pittsfield/Housatonic River Site, Pittsfield, Massachusetts**

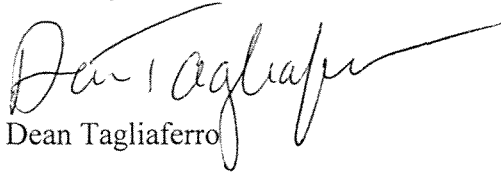
Enclosed please find the following:

- *Final Specifications for the Phase 1/Phase 2 Transition Area of the 1.5 Mile Removal Action*, by Weston Solutions, April 2003 (ABRG)
- *Final Design Submittal Drawings, Phase 1/Phase 2 Transition*
- *Supplemental Design Information for the Phase 1/Phase 2 Transition Area of the 1.5 Mile Reach Removal Action*, by Weston Solutions, June 27, 2003 (ABRG)

The Phase 1/Phase 2 Transition Area of the 1.5 Mile Removal Action encompasses approximately 750 feet from the end of the Phase 1 to the Elm Street bridge. Also included in the plans and specifications is the gravity bypass dam and piping system. The supplemental design information includes the following: amendments to the final drawings and specifications; summary tables regarding excavation volumes, backfill volumes, TSCA and non-TSCA volumes, and changes in flood storage capacity; and information on the projected impacts of the construction during high flow events.

If you have any questions, please contact me at (413) 236-0969.

Sincerely,

A handwritten signature in black ink, appearing to read "Dean Tagliaferro", with a long, sweeping horizontal line extending to the right.

Dean Tagliaferro

Enclosures

This document provides supplemental information prepared as part of the finalization of the Phase 1/Phase 2 Transition Area design. The paragraphs below provide a brief description of the information, and pertinent tables and figures are included as Attachments to this document. The three main elements presented in this document are as follows:

- Amendments to the Final Drawings and Specifications
- Tables listing excavation and backfill volumes and associated flood storage changes for the Transition Phase and for the Lyman to Elm Street reach of the 1.5 Mile Reach. The Lyman to Elm Street reach encompasses Phase 1 and the Phase 1/Phase 2 Transition Area of the 1.5 Mile Reach.
- Documentation of the HEC-RAS Model results for Lyman to Elm Street

### **Amendments to the Design**

Based on additional comments provided by the Army Corps of Engineers (ACOE) and USEPA, Weston has provided a list of Amendments to the Transition Phase Specifications and Drawings. These Amendments are included in Attachment A to this document. There are a total of 28 amendments to the design, mostly editorial in nature.

### **Final Excavation and Backfill Volumes**

Weston conducted analysis and calculations relative to the excavation and backfill amounts and resulting flood storage capacity changes based on the final design for the Transition Phase. The results of the calculations are provided in Attachment B in the form of two sets of four tables for the Transition Area and for the Lyman Street to Elm Street Reach, respectively. These tables are as follows:

Table B-1	Final Transition Area Design Excavation and Backfill Volumes
Table B-2	Final Transition Area Design Excavation Volumes by Soil/Sediment Classification
Table B-3	Summary of Estimated Flood Storage Capacity Changes for Transition Reach
Table B-4	Comparison of Excavation Volume Estimates in Cubic Yards for Transition Area
Table B-5	Design Excavation and Backfill Volumes – Lyman to Elm
Table B-6	Design Excavation Volumes by Soil/Sediment Classification – Lyman to Elm
Table B-7	Summary of Estimated Flood Storage Capacity Changes – Lyman to Elm
Table B-8	Comparison of Excavation Volume Estimates in Cubic Yards for Lyman to Elm Street Area



Based on the calculations and as documented in the tables in Attachment B, the total amount of flood storage capacity gain in the Transition Area is 700 cubic yards, and the total amount of flood storage capacity gain from Lyman to Elm Streets is 1,900 cubic yards.

### **HEC RAS Model Results**

Summarized below and in Attachment C are the updated results of the HEC-RAS modeling based on input of the final design cross-sections for the Transition Phase. Below is a summary of the results and conclusions derived from the modeling. Note that these results and the documentation below will be incorporated into the Draft Final Basis of Design document for Phase II.

### **HEC-RAS Model Input Changes**

New cross-section geometry was updated in April 2003. The new geometry was entered into the HEC-RAS model for transition area stations 514+00 through 521+00. Due to the new retaining wall scheme (varying riprap sizes for the channel and bank, and vegetative cover beyond the river bank armor), the Manning's 'n' roughness coefficients were changed accordingly. These changes were dictated by the notes provided on the Drawings: *Existing and Proposed Riverbank Cross-Sections, Sheets 1 and 2 (Sheet reference numbers 2008 and 2009)*. The Manning's 'n' value formula used for channel and lower bank design conditions is as follows:

$$n = y^{1/6} / [21.6 \log_{10}(y/d_{50}) + 14]$$

where  $y$  = depth of flow (ft) and  $d_{50}$  = riprap size (ft)

The depths of flow vary from station to station throughout the transition area. They were approximated from the existing model output during the 10-yr design storm. Three different riprap sizes are used in the transition area, 9-in, 12-in, and 18 in. On all cross-sections within the transition area, 18-in riprap is used for the 1:1 sheet-pile wall covering and the areas from the edge of river up to the vegetative cover. This resulted in Manning's n values of 0.037 to 0.045 for the Transition Area (Station 514+00 to the Elm St. bridge) for the lower banks and channel. Note that the Manning's value used for the channel from Stations 500+00 to 514+00 (Phase 1) was 0.033 for the design condition. The Manning's value for the post-construction vegetative cover (design conditions) is generally the same as for existing conditions. This is based on eventual re-establishment of trees and vegetation. Manning's values used for overbank and floodplain areas range from 0.02 to 0.1, and were not changed from existing to design conditions. Existing conditions in these areas range from paved areas to heavily wooded/brush areas. The Manning's values used are considered reasonably conservative for the final restored river channel configuration

### HEC-RAS Model Results Summary

The HEC-RAS model water surface elevation results were evaluated from Construction Stations 500+00 through 521+00 (Lyman Street to Elm Street). A tabular summary of the model results is provided in Table C-1. Four sets of two model output figures are also provided depicting flood stage heights for the 100, 50, 10 and 5-year storms. For each storm, one figure shows existing conditions versus design condition flood stage height, and the second figure shows design condition flood stage height versus top of bank elevations.

The modeling results for Lyman Street to Elm Street show that the implementation of the removal action as designed will not significantly alter flood elevations or river flow velocities in this reach. The maximum increase in river flow velocity is 1.01 ft/sec during the 10-year storm event (4,375 cfs) at Station 506+00 (increase from 4 to 5 ft/sec). The maximum increase in water surface elevation is 0.38 ft. at Station 519+50, and occurs during the 10-yr storm event (4,375 cfs) and within approximately 200 ft. upstream of the Elm St. bridge. The maximum water surface elevation increase at Lyman Street (Station 500+00) is 0.14 feet, also during the 10-yr storm.

## Attachment A

## **Final Specifications and Drawings for the Phase 1/Phase 2 Transition Area 1.5 Mile Reach Removal Action**

### **I. Amendments to Specifications**

#### **Specification Section 01025 – MEASUREMENT AND PAYMENT**

1. In the last sentence of Paragraph 1.1.5b, "River Diversion System Gravity Operation," replace the word "pumping" with "gravity."

#### **Specification Section 01330 – SUBMITTAL PROCEDURES**

2. On page 3 of 3 of the Submittal Register (attached table), Item 103, under "Description of Item Submitted," correct spelling to "structure" instead of "struction."
3. Add to Submittal Register, submittals for slide gates and pipe as indicated in items 15 and 18 below.

#### **Specification Section 02300 - EARTHWORK**

5. Delete the reference to ASTM C 33 under Paragraph 1.1 "References."
6. Paragraph 2.3, delete "ASTM C33" and replace with "the State Specifications for Highways and Bridges".

#### **Specification Section 02370 – STORMWATER AND EROSION CONTROL: IN-RIVER WORK**

7. On Page 02370-20, Subsection 3.3.2.3 "Monitoring to Anticipate a Flood Event," change the first sentence in paragraph a as follows: after "Gaging Station" add "corrected for the site's downstream location" and after "maximum flow" add "(estimated at approximately 180 cfs)."

#### **Specification Section 11000, HOUSATONIC RIVER BYPASS GRAVITY FLOW SYSTEM**

8. In Paragraph 1.2b, change "electric" to "manual" in item 3.
9. In subsection 2.1, paragraph g, change the sentence as follows: "...the Pre-Design Document and Basis of Design Document for Phase 2."
10. Change last bullet under Paragraph 2.1, part I, to "Net force of zero applied to connection with conveyance piping at dam."
11. Under Paragraph 2.1 item k, at the end of the first sentence, add the following, "or one inlet structure covering both gravity intakes. In either case, each inlet structure

must allow for raising and lowering of the slide gates individually or must be easily removed for lowering of the slide gates."

12. Under Paragraph 2.2, at end of first sentence, remove the word "intake."
13. In Paragraph 3.2, beneath the bullets under item no. 2, add the following "In addition, installation shall conform with appropriate ASTM standards as referenced by the above PPI standards (see also Specification Section 15064 - PLASTIC PIPE, paragraph 2.2.)"
14. At the end of paragraph 3.2, add no. 7: "Flanged connections must be installed per the manufacturers instructions. The two pipes being joined via flanges shall be in full contact at the joining edge prior to tightening of the flange bolts. In no instances shall the flanged fittings and bolts be used to pull two pieces of pipe together."

#### **Specification Section 11160 – SLIDE GATES**

15. Add Paragraph 1.2 Submittals and include:

Submit under the provisions of Section 01330.

##### **SD-02 Shop Drawings**

Include dimensions and details of construction of slide gates, operators and appurtenances proposed for use.

##### **SD-10 Operation and Maintenance Data**

Operation and maintenance manuals shall be submitted with or before delivery of the slide gates to the site.

16. Under Part 3 - Execution, delete section 3.1 - Submittals.
17. Under Section 3.2, Installation, the text should read "Slide gates and operators shall be installed per manufacturer's instructions."

#### **Specification Section 11800 - WATER TREATMENT SYSTEM**

18. Modify the last sentence in Section 1.1, "System Overview" to the following: "It does not include conveyance piping from the discharge of the excavation dewatering system to the treatment system and other components of the dewatering system as required by Specification Section 02300, "EARTHWORK."

**Specification Section 15064 - PLASTIC PIPE**

19. Insert new paragraph 1.3 Submittals and include:

**SD-03 Product Data**

Submit manufacturer's product data for pipe and fittings including materials of construction, dimensions and physical characteristics.

**SD-06 Test Reports**

Submit information pertaining to making each fusion weld including: ambient weather conditions (temperature, wind speed, cloud cover and precipitation), operator's name, current certificate qualifying the operator to operate the fusion equipment used, pressure applied, time of applied pressure and temperature of joint during the fusion process.

**SD-07 Certificates**

Training certificates of personnel performing fusion welding shall be submitted prior to any fusion welding. Certificates shall qualify each operator to operate the fusion equipment used.

**SD-08 Manufacturer's Instructions**

Submit manufacturer's design, installation, handling, joining and maintenance instructions.

20. Add the following to paragraph 2.1 GENERAL: after "ASTM" add "and PPI".

**II. Amendments to Drawings**

**Sheet 2001 – TRANSITION AREA RETAINING WALL SECTIONS AND ARMOR DETAILS**

21. At each detail, add "(left)" and "(right)" next to all instances of "east" and "west" banks.

**Sheet 2003 – DIVERSION DAM ELEVATION**

22. Add the following note to east and west sides at existing ground surface elevation 976 feet: "Sheetpile shall be extended 25 feet into bank beyond existing ground surface elevation 976 feet. See also Sheet 2002."

23. Delete Note 1.

**Sheet 2004 – DIVERSION DAM DETAILS 1**

24. Change 2' 0" vertical dimension in Section A indicating sheetpile penetration includes pile cap to 1' 6".

25. Sections A and B, change note at middle right to "ALL PIER BRACING  $\angle^S$  3 1/2 x 3 1/2 x 1/4 CONNECTION AT INTERSECTION."

**Sheet 2005 – DIVERSION DAM WALKWAY PLAN AND DETAILS SHEET 1 OF 2**

26. In the upper left of the sheet (Walkway Plan), the 10" dimension should be corrected to 9" and the 1' 0" dimension should be corrected to 1' 1".

27. Note 2 under "WALKWAY PLAN" should read as follows: "ALL HORIZONTAL X-BRACING  $\angle^S$  2 1/2 x 2 1/2 x 1/4."

**Sheet 2007 – EXISTING AND PROPOSED RIVERBANK CROSS SECTIONS SHEET 1 OF 2**

28. Add note immediately below "Armor Elevations" to state the following: "Upper elevation of riverbed armor shall be 971 feet."

## Attachment B



**Table B-1 - Final Transition Area (Station 514+00 to Elm St.) Design Excavation and Backfill Volumes**

	Cut (CY)	Fill (CY)
East Bank	1,900	2,000
River Bed	5,400	4,500
West Bank	1,900	2,000
Total	9,200	8,500
Overexcavation (@10%)	900	900
Total (w/ overexcavation)	10,100	9,400

**Table B-2 - Final Transition Area (Station 514+00 to Elm St.) Design Excavation Volumes by Soil/Sediment Classification**

Soil/Sediment Classification	In-Place Volume	Total With Overexcavation Factor of 10%
Bank Soil (TSCA)	900	1,000
Riverbed (TSCA)	700	800
Total TSCA	1,600	1,800
non-TSCA	7,600	8,300
Total	9,200	10,100

**Table B-3  
Summary of Estimated Flood Storage Capacity (FSC) Changes for Transition Reach  
(Station 514+00 to Elm St.)**

Section	Volume in cubic yards <sup>1</sup>
Volume of Material to be Excavated	10,100
Volume of Material to be Backfilled	(9,400)
Net Change between the Existing Conditions and the Final Transition Area Design Excavation/Backfilling	700

<sup>1</sup> Positive value indicates net increase and negative value indicates loss.

**Table B-4  
Comparison of Excavation Volume Estimates in Cubic Yards  
(in-place volume) for Transition Area (Station 514+00 to Elm St.)**

Location	EE/CA	Final Design Calculation
East Bank	1,700	1,900
River	5,500	5,400
West Bank	3,000	1,900
Total (in place)	10,200	9,200
Total with 10% Overexcavation Factor	11,200	10,100

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**Table B-5**  
**Design Excavation and Backfill Volumes**  
**Lyman to Elm**

	Lyman to 514+00		514+00 to Elm		Lyman to Elm	
	Cut (CY)	Fill (CY)	Cut (CY)	Fill (CY)	Cut (CY)	Fill (CY)
East Bank	5,200	5,000	1,900	2,000	7,100	7,000
River Bed	8,200	7,300	5,400	4,500	13,600	11,800
West Bank	4,500	4,400	1,900	2,000	6,400	6,400
<b>Total</b>	<b>17,900</b>	<b>16,700</b>	<b>9,200</b>	<b>8,500</b>	<b>27,100</b>	<b>25,200</b>
Overexcavation (@10%)	1,800	1,800	900	900	2,700	2,700
<b>Total (w/ overexcavation)</b>	<b>19,700</b>	<b>18,500</b>	<b>10,100</b>	<b>9,400</b>	<b>29,800</b>	<b>27,900</b>

Note: Fill volumes for the Lyman St. to Elm St. reach represent corrected values. A 200 cy error was discovered in the Phase 1 BOD report.

**Table B-6**  
**Final Design Excavation Volumes by Soil/Sediment Classification**  
**Lyman to Elm**

Soil/Sediment Classification	Lyman to Station 514+00		Station 514+00 to Elm St.		Lyman St. to Elm St.	
	In-Place Volume	Total With Overexcavation Factor of 10%	In-Place Volume	Total With Overexcavation Factor of 10%	In-Place Volume	Total With Overexcavation Factor of 10%
Total TSCA Material	2,900	3,200	1,600	1,800	4,500	5,000
non-TSCA	15,000	16,500	7,600	8,300	22,600	24,800
<b>Total</b>	<b>17,900</b>	<b>19,700</b>	<b>9,200</b>	<b>10,100</b>	<b>27,100</b>	<b>29,800</b>

**Table B-7 Summary of Estimated Flood Storage Capacity (FSC) Changes**  
**Lyman to Elm**

	Volume in cubic yards <sup>1</sup>		
	Lyman to 514+00	514+00 to Elm	Lyman to Elm
Volume of Material to be Excavated	19,700	10,100	29,800
Volume of Material to be Backfilled	(18,500)	(9,400)	(27,900)
<b>Net Increase in Flood Storage Capacity</b>	<b>1,200</b>	<b>700</b>	<b>1,900</b>

1. Positive value indicates net increase and negative value indicates loss.

**Table B-8**  
**Comparison of Excavation Volume Estimates in Cubic Yards (in-place volume) for Lyman to Elm Street Area**

Location	Volume in cubic yards					
	Lyman to 514+00		514+00 to Elm		Lyman to Elm	
	EE/CA	Final Design Calculation	EE/CA	Final Design Calculation	EE/CA	Final Design Calculation
East Bank	4,200	5,200	1,700	1,900	5,900	7,100
River	8,200	8,200	5,500	5,400	13,700	13,600
West Bank	4,200	4,500	3,000	1,900	7,200	6,400
<b>Total (in place)</b>	<b>16,600</b>	<b>17,900</b>	<b>10,200</b>	<b>9,200</b>	<b>26,800</b>	<b>27,100</b>
<b>Total with 10% Overexcavation Factor</b>	<b>18,300</b>	<b>19,700</b>	<b>11,200</b>	<b>10,100</b>	<b>29,500</b>	<b>29,800</b>

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## Attachment C

Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta$ El. (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft.)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
500+00	51948	Avg Annual	134	971.69	1.82	134	971.59	1.97	0.15	-0.1	985	985
500+00	51948	0.125-yr	460	973.56	2.55	460	973.43	2.67	0.12	-0.13	985	985
500+00	51948	0.25-yr	976	975.43	3.25	976	975.27	3.37	0.12	-0.16	985	985
500+00	51948	0.5-yr	1422	976.61	3.74	1422	976.48	3.83	0.09	-0.13	985	985
500+00	51948	0.75-yr	1612	977.05	3.92	1612	976.94	4	0.08	-0.11	985	985
500+00	51948	1-yr	1670	977.18	3.97	1670	977.07	4.05	0.08	-0.11	985	985
500+00	51948	1.5-yr	1761	977.38	4.05	1761	977.28	4.12	0.07	-0.1	985	985
500+00	51948	2-yr	2047	977.97	4.29	2047	977.91	4.33	0.04	-0.06	985	985
500+00	51948	5-yr	3336	980.31	5.07	3336	980.37	5.03	-0.04	0.06	985	985
500+00	51948	10-yr	4375	981.91	5.53	4375	982.05	5.45	-0.08	0.14	985	985
500+00	51948	50-yr	7239	986.19	3.56	7239	986.21	3.69	0.13	0.02	985	985
500+00	51948	100-yr	8721	988.04	2.37	8721	988.02	2.54	0.17	-0.02	985	985
500+50	51900	Avg Annual	134	971.71	0.89	134	971.62	0.75	-0.14	-0.09	983	984
500+50	51900	0.125-yr	460	973.58	1.73	460	973.47	1.52	-0.21	-0.11	983	984
500+50	51900	0.25-yr	976	975.45	2.48	976	975.32	2.23	-0.25	-0.13	983	984
500+50	51900	0.5-yr	1422	976.64	2.95	1422	976.54	2.69	-0.26	-0.1	983	984
500+50	51900	0.75-yr	1612	977.09	3.14	1612	977	2.85	-0.29	-0.09	983	984
500+50	51900	1-yr	1670	977.22	3.19	1670	977.14	2.9	-0.29	-0.08	983	984
500+50	51900	1.5-yr	1761	977.42	3.27	1761	977.35	2.98	-0.29	-0.07	983	984
500+50	51900	2-yr	2047	978.01	3.51	2047	977.98	3.2	-0.31	-0.03	983	984
500+50	51900	5-yr	3336	980.35	4.39	3336	980.45	4	-0.39	0.1	983	984
500+50	51900	10-yr	4375	981.95	4.93	4375	982.13	4.5	-0.43	0.18	983	984
500+50	51900	50-yr	7239	985.86	5.43	7239	985.95	5.09	-0.34	0.09	983	984
500+50	51900	100-yr	8721	987.71	5.2	8721	987.72	4.98	-0.22	0.01	983	984
501+00	51850	Avg Annual	134	971.7	0.81	134	971.61	0.93	0.12	-0.09	981.98	984.02
501+00	51850	0.125-yr	460	973.57	1.59	460	973.44	1.82	0.23	-0.13	981.98	984.02
501+00	51850	0.25-yr	976	975.45	2.3	976	975.27	2.62	0.32	-0.18	981.98	984.02
501+00	51850	0.5-yr	1422	976.64	2.77	1422	976.48	3.12	0.35	-0.16	981.98	984.02
501+00	51850	0.75-yr	1612	977.08	2.95	1612	976.94	3.31	0.36	-0.14	981.98	984.02
501+00	51850	1-yr	1670	977.22	3	1670	977.07	3.36	0.36	-0.15	981.98	984.02
501+00	51850	1.5-yr	1761	977.41	3.08	1761	977.28	3.44	0.36	-0.13	981.98	984.02
501+00	51850	2-yr	2047	978.01	3.31	2047	977.9	3.68	0.37	-0.11	981.98	984.02
501+00	51850	5-yr	3336	980.35	4.14	3336	980.35	4.55	0.41	0	981.98	984.02
501+00	51850	10-yr	4375	981.97	4.65	4375	982.02	5.09	0.44	0.05	981.98	984.02
501+00	51850	50-yr	7239	985.88	5.09	7239	985.87	5.59	0.5	-0.01	981.98	984.02
501+00	51850	100-yr	8721	987.72	4.95	8721	987.65	5.45	0.5	-0.07	981.98	984.02
Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.										0		

Table C-1 Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta El.$ (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
501+50	51800	Avg Annual	134	971.68	1.25	134	971.6	1.06	-0.19	-0.08	983.55	981
501+50	51800	0.125-yr	460	973.53	2.13	460	973.41	2.01	-0.12	-0.12	983.55	981
501+50	51800	0.25-yr	976	975.38	2.87	976	975.23	2.83	-0.04	-0.15	983.55	981
501+50	51800	0.5-yr	1422	976.56	3.36	1422	976.43	3.34	-0.02	-0.13	983.55	981
501+50	51800	0.75-yr	1612	977	3.55	1612	976.89	3.52	-0.03	-0.11	983.55	981
501+50	51800	1-yr	1670	977.13	3.6	1670	977.03	3.57	-0.03	-0.1	983.55	981
501+50	51800	1.5-yr	1761	977.32	3.68	1761	977.23	3.65	-0.03	-0.09	983.55	981
501+50	51800	2-yr	2047	977.91	3.93	2047	977.86	3.88	-0.05	-0.05	983.55	981
501+50	51800	5-yr	3336	980.23	4.8	3336	980.31	4.7	-0.1	0.08	983.55	981
501+50	51800	10-yr	4375	981.84	5.26	4375	982	5.13	-0.13	0.16	983.55	981
501+50	51800	50-yr	7239	985.86	5.27	7239	985.9	5.26	-0.01	0.04	983.55	981
501+50	51800	100-yr	8721	987.71	5.02	8721	987.68	5.07	0.05	-0.03	983.55	981
502+00	51750	Avg Annual	134	971.65	1.43	134	971.59	1.05	-0.38	-0.06	981	979
502+00	51750	0.125-yr	460	973.49	2.29	460	973.4	1.89	-0.4	-0.09	981	979
502+00	51750	0.25-yr	976	975.34	3	976	975.22	2.59	-0.41	-0.12	981	979
502+00	51750	0.5-yr	1422	976.52	3.45	1422	976.43	3.02	-0.43	-0.09	981	979
502+00	51750	0.75-yr	1612	976.96	3.62	1612	976.89	3.17	-0.45	-0.07	981	979
502+00	51750	1-yr	1670	977.09	3.67	1670	977.03	3.22	-0.45	-0.06	981	979
502+00	51750	1.5-yr	1761	977.29	3.75	1761	977.24	3.29	-0.46	-0.05	981	979
502+00	51750	2-yr	2047	977.88	3.98	2047	977.86	3.49	-0.49	-0.02	981	979
502+00	51750	5-yr	3336	980.2	4.8	3336	980.33	4.2	-0.6	0.13	981	979
502+00	51750	10-yr	4375	981.83	5.14	4375	982.03	4.53	-0.61	0.2	981	979
502+00	51750	50-yr	7239	985.89	4.84	7239	985.94	4.61	-0.23	0.05	981	979
502+00	51750	100-yr	8721	987.74	4.57	8721	987.71	4.49	-0.08	-0.03	981	979
502+50	51700	Avg Annual	134	971.64	1.1	134	971.57	1.1	0	-0.07	979	979
502+50	51700	0.125-yr	460	973.49	1.87	460	973.38	1.92	0.05	-0.11	979	979
502+50	51700	0.25-yr	976	975.34	2.54	976	975.2	2.64	0.1	-0.14	979	979
502+50	51700	0.5-yr	1422	976.53	2.98	1422	976.4	3.09	0.11	-0.13	979	979
502+50	51700	0.75-yr	1612	976.97	3.14	1612	976.86	3.25	0.11	-0.11	979	979
502+50	51700	1-yr	1670	977.1	3.19	1670	977	3.3	0.11	-0.1	979	979
502+50	51700	1.5-yr	1761	977.3	3.27	1761	977.21	3.37	0.1	-0.09	979	979
502+50	51700	2-yr	2047	977.89	3.49	2047	977.83	3.58	0.09	-0.06	979	979
502+50	51700	5-yr	3336	980.28	3.77	3336	980.36	3.8	0.03	0.08	979	979
502+50	51700	10-yr	4375	981.97	3.59	4375	982.12	3.6	0.01	0.15	979	979
502+50	51700	50-yr	7239	986.01	3.11	7239	986.04	3.17	0.06	0.03	979	979
502+50	51700	100-yr	8721	987.83	3.02	8721	987.8	3.09	0.07	-0.03	979	979

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.

Table C-1												
Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta El.$ (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
503+00	51650	Avg Annual	134	971.63	0.99	134	971.56	1.2	0.21	-0.07	979.27	979
503+00	51650	0.125-yr	460	973.48	1.56	460	973.36	1.99	0.43	-0.12	979.27	979
503+00	51650	0.25-yr	976	975.34	2.09	976	975.17	2.69	0.6	-0.17	979.27	979
503+00	51650	0.5-yr	1422	976.54	2.45	1422	976.38	3.13	0.68	-0.16	979.27	979
503+00	51650	0.75-yr	1612	976.98	2.59	1612	976.84	3.29	0.7	-0.14	979.27	979
503+00	51650	1-yr	1670	977.11	2.63	1670	976.97	3.34	0.71	-0.14	979.27	979
503+00	51650	1.5-yr	1761	977.31	2.69	1761	977.18	3.41	0.72	-0.13	979.27	979
503+00	51650	2-yr	2047	977.91	2.88	2047	977.8	3.62	0.74	-0.11	979.27	979
503+00	51650	5-yr	3336	980.28	3.44	3336	980.28	4.16	0.72	0	979.27	979
503+00	51650	10-yr	4375	981.94	3.59	4375	982.03	4.15	0.56	0.09	979.27	979
503+00	51650	50-yr	7239	985.95	3.56	7239	985.96	3.97	0.41	0.01	979.27	979
503+00	51650	100-yr	8721	987.77	3.57	8721	987.73	3.96	0.39	-0.04	979.27	979
503+50	51600	Avg Annual	134	971.57	1.69	134	971.51	1.71	0.02	-0.06	978	980.69
503+50	51600	0.125-yr	460	973.41	2.3	460	973.29	2.52	0.22	-0.12	978	980.69
503+50	51600	0.25-yr	976	975.26	2.77	976	975.1	3.08	0.31	-0.16	978	980.69
503+50	51600	0.5-yr	1422	976.45	3.09	1422	976.31	3.45	0.36	-0.14	978	980.69
503+50	51600	0.75-yr	1612	976.9	3.21	1612	976.77	3.59	0.38	-0.13	978	980.69
503+50	51600	1-yr	1670	977.03	3.25	1670	976.91	3.63	0.38	-0.12	978	980.69
503+50	51600	1.5-yr	1761	977.23	3.3	1761	977.12	3.7	0.4	-0.11	978	980.69
503+50	51600	2-yr	2047	977.83	3.45	2047	977.75	3.87	0.42	-0.08	978	980.69
503+50	51600	5-yr	3336	980.2	3.9	3336	980.24	4.32	0.42	0.04	978	980.69
503+50	51600	10-yr	4375	981.88	3.91	4375	981.99	4.29	0.38	0.11	978	980.69
503+50	51600	50-yr	7239	985.94	3.6	7239	985.95	4	0.4	0.01	978	980.69
503+50	51600	100-yr	8721	987.77	3.52	8721	987.72	3.93	0.41	-0.05	978	980.69
504+50	51500	Avg Annual	134	971.5	1.33	134	971.42	1.84	0.51	-0.08	982	981.64
504+50	51500	0.125-yr	460	973.35	1.96	460	973.17	2.66	0.7	-0.18	982	981.64
504+50	51500	0.25-yr	976	975.21	2.5	976	975.02	3.15	0.65	-0.19	982	981.64
504+50	51500	0.5-yr	1422	976.4	2.84	1422	976.24	3.5	0.66	-0.16	982	981.64
504+50	51500	0.75-yr	1612	976.85	2.96	1612	976.7	3.64	0.68	-0.15	982	981.64
504+50	51500	1-yr	1670	976.98	3	1670	976.84	3.68	0.68	-0.14	982	981.64
504+50	51500	1.5-yr	1761	977.18	3.05	1761	977.05	3.74	0.69	-0.13	982	981.64
504+50	51500	2-yr	2047	977.78	3.21	2047	977.68	3.92	0.71	-0.1	982	981.64
504+50	51500	5-yr	3336	980.16	3.75	3336	980.13	4.58	0.83	-0.03	982	981.64
504+50	51500	10-yr	4375	981.81	4.02	4375	981.83	4.87	0.85	0.02	982	981.64
504+50	51500	50-yr	7239	985.9	3.72	7239	985.85	4.52	0.8	-0.05	982	981.64
504+50	51500	100-yr	8721	987.74	3.54	8721	987.65	4.3	0.76	-0.09	982	981.64
Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.												

Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta$ El. (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
505+00	51450	Avg Annual	134	971.49	0.98	134	971.43	0.93	-0.05	-0.06	982	981
505+00	51450	0.125-yr	460	973.33	1.72	460	973.19	1.79	0.07	-0.14	982	981
505+00	51450	0.25-yr	976	975.19	2.36	976	975.03	2.51	0.15	-0.16	982	981
505+00	51450	0.5-yr	1422	976.38	2.75	1422	976.25	2.94	0.19	-0.13	982	981
505+00	51450	0.75-yr	1612	976.83	2.89	1612	976.71	3.09	0.2	-0.12	982	981
505+00	51450	1-yr	1670	976.96	2.92	1670	976.85	3.14	0.22	-0.11	982	981
505+00	51450	1.5-yr	1761	977.16	2.98	1761	977.06	3.21	0.23	-0.1	982	981
505+00	51450	2-yr	2047	977.76	3.16	2047	977.69	3.4	0.24	-0.07	982	981
505+00	51450	5-yr	3336	980.14	3.72	3336	980.16	4.03	0.31	0.02	982	981
505+00	51450	10-yr	4375	981.79	4.01	4375	981.86	4.36	0.35	0.07	982	981
505+00	51450	50-yr	7239	985.83	4.13	7239	985.81	4.59	0.46	-0.02	982	981
505+00	51450	100-yr	8721	987.67	4.04	8721	987.6	4.53	0.49	-0.07	982	981
505+50	51400	Avg Annual	134	971.46	1.3	134	971.39	1.65	0.35	-0.07	983	981
505+50	51400	0.125-yr	460	973.29	2.04	460	973.12	2.37	0.33	-0.17	983	981
505+50	51400	0.25-yr	976	975.14	2.67	976	974.96	3	0.33	-0.18	983	981
505+50	51400	0.5-yr	1422	976.33	3.07	1422	976.17	3.4	0.33	-0.16	983	981
505+50	51400	0.75-yr	1612	976.77	3.22	1612	976.64	3.54	0.32	-0.13	983	981
505+50	51400	1-yr	1670	976.9	3.26	1670	976.78	3.58	0.32	-0.12	983	981
505+50	51400	1.5-yr	1761	977.1	3.33	1761	976.99	3.65	0.32	-0.11	983	981
505+50	51400	2-yr	2047	977.69	3.52	2047	977.62	3.83	0.31	-0.07	983	981
505+50	51400	5-yr	3336	980.06	4.17	3336	980.08	4.43	0.26	0.02	983	981
505+50	51400	10-yr	4375	981.7	4.53	4375	981.79	4.71	0.18	0.09	983	981
505+50	51400	50-yr	7239	985.76	4.59	7239	985.76	4.87	0.28	0	983	981
505+50	51400	100-yr	8721	987.63	4.4	8721	987.57	4.71	0.31	-0.06	983	981
506+00	51350	Avg Annual	134	971.44	1.22	134	971.37	1.37	0.15	-0.07	982	980
506+00	51350	0.125-yr	460	973.27	1.96	460	973.08	2.48	0.52	-0.19	982	980
506+00	51350	0.25-yr	976	975.12	2.59	976	974.89	3.32	0.73	-0.23	982	980
506+00	51350	0.5-yr	1422	976.31	2.98	1422	976.09	3.79	0.81	-0.22	982	980
506+00	51350	0.75-yr	1612	976.75	3.12	1612	976.55	3.95	0.83	-0.2	982	980
506+00	51350	1-yr	1670	976.88	3.16	1670	976.69	4	0.84	-0.19	982	980
506+00	51350	1.5-yr	1761	977.08	3.22	1761	976.9	4.07	0.85	-0.18	982	980
506+00	51350	2-yr	2047	977.68	3.39	2047	977.52	4.28	0.89	-0.16	982	980
506+00	51350	5-yr	3336	980.05	3.91	3336	980	4.87	0.96	-0.05	982	980
506+00	51350	10-yr	4375	981.71	4.13	4375	981.71	5.14	1.01	0	982	980
506+00	51350	50-yr	7239	985.78	4.14	7239	985.76	4.94	0.8	-0.02	982	980
506+00	51350	100-yr	8721	987.66	3.84	8721	987.58	4.62	0.78	-0.08	982	980

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.

Table C-1 Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta El.$ (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
506+50	51300	Avg Annual	134	971.43	0.99	134	971.35	1.45	0.46	-0.08	982	978
506+50	51300	0.125-yr	460	973.26	1.71	460	973.05	2.42	0.71	-0.21	982	978
506+50	51300	0.25-yr	976	975.12	2.29	976	974.87	3.07	0.78	-0.25	982	978
506+50	51300	0.5-yr	1422	976.3	2.66	1422	976.08	3.48	0.82	-0.22	982	978
506+50	51300	0.75-yr	1612	976.75	2.79	1612	976.54	3.63	0.84	-0.21	982	978
506+50	51300	1-yr	1670	976.88	2.83	1670	976.68	3.68	0.85	-0.2	982	978
506+50	51300	1.5-yr	1761	977.08	2.89	1761	976.89	3.74	0.85	-0.19	982	978
506+50	51300	2-yr	2047	977.68	3.05	2047	977.52	3.92	0.87	-0.16	982	978
506+50	51300	5-yr	3336	980.06	3.57	3336	980.01	4.44	0.87	-0.05	982	978
506+50	51300	10-yr	4375	981.72	3.8	4375	981.74	4.64	0.84	0.02	982	978
506+50	51300	50-yr	7239	985.8	3.68	7239	985.77	4.49	0.81	-0.03	982	978
506+50	51300	100-yr	8721	987.68	3.38	8721	987.59	4.19	0.81	-0.09	982	978
507+00	51250	Avg Annual	134	971.41	1.17	134	971.34	1.06	-0.11	-0.07	982	978
507+00	51250	0.125-yr	460	973.23	1.91	460	973.05	1.95	0.04	-0.18	982	978
507+00	51250	0.25-yr	976	975.08	2.52	976	974.86	2.68	0.16	-0.22	982	978
507+00	51250	0.5-yr	1422	976.26	2.93	1422	976.08	3.13	0.2	-0.18	982	978
507+00	51250	0.75-yr	1612	976.7	3.09	1612	976.54	3.3	0.21	-0.16	982	978
507+00	51250	1-yr	1670	976.82	3.13	1670	976.68	3.35	0.22	-0.14	982	978
507+00	51250	1.5-yr	1761	977.02	3.2	1761	976.89	3.42	0.22	-0.13	982	978
507+00	51250	2-yr	2047	977.62	3.4	2047	977.52	3.64	0.24	-0.1	982	978
507+00	51250	5-yr	3336	979.97	4.09	3336	980	4.26	0.17	0.03	982	978
507+00	51250	10-yr	4375	981.62	4.4	4375	981.74	4.37	-0.03	0.12	982	978
507+00	51250	50-yr	7239	985.73	4.22	7239	985.81	3.75	-0.47	0.08	982	978
507+00	51250	100-yr	8721	987.63	3.86	8721	987.62	3.45	-0.41	-0.01	982	978
507+50	51200	Avg Annual	134	971.4	1	134	971.34	0.67	-0.33	-0.06	982	980
507+50	51200	0.125-yr	460	973.22	1.8	460	973.06	1.16	-0.64	-0.16	982	980
507+50	51200	0.25-yr	976	975.06	2.41	976	974.9	1.59	-0.82	-0.16	982	980
507+50	51200	0.5-yr	1422	976.24	2.78	1422	976.13	1.87	-0.91	-0.11	982	980
507+50	51200	0.75-yr	1612	976.68	2.92	1612	976.6	1.97	-0.95	-0.08	982	980
507+50	51200	1-yr	1670	976.81	2.96	1670	976.74	2	-0.96	-0.07	982	980
507+50	51200	1.5-yr	1761	977.01	3.02	1761	976.96	2.05	-0.97	-0.05	982	980
507+50	51200	2-yr	2047	977.61	3.2	2047	977.59	2.19	-1.01	-0.02	982	980
507+50	51200	5-yr	3336	979.98	3.76	3336	980.1	2.67	-1.09	0.12	982	980
507+50	51200	10-yr	4375	981.62	4.11	4375	981.82	2.93	-1.18	0.2	982	980
507+50	51200	50-yr	7239	985.72	4.09	7239	985.83	3.05	-1.04	0.11	982	980
507+50	51200	100-yr	8721	987.62	3.78	8721	987.63	2.93	-0.85	0.01	982	980
Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.												



Table C-1 Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
			Existing			Design						
Station	Rvr. Sta.	Profile	Q (cfs)	El. (ft.)	V (fps)	Q (cfs)	El. (ft)	V (fps)	Δ V (fps)	Δ El. (ft)	TOB El. East	TOB El. West
508+00	51150	Avg Annual	134	971.4	0.87	134	971.33	0.85	-0.02	-0.07	982	978
508+00	51150	0.125-yr	460	973.21	1.61	460	973.02	1.76	0.15	-0.19	982	978
508+00	51150	0.25-yr	976	975.05	2.24	976	974.82	2.54	0.3	-0.23	982	978
508+00	51150	0.5-yr	1422	976.23	2.63	1422	976.03	2.99	0.36	-0.2	982	978
508+00	51150	0.75-yr	1612	976.67	2.78	1612	976.49	3.15	0.37	-0.18	982	978
508+00	51150	1-yr	1670	976.8	2.83	1670	976.62	3.2	0.37	-0.18	982	978
508+00	51150	1.5-yr	1761	977	2.9	1761	976.83	3.28	0.38	-0.17	982	978
508+00	51150	2-yr	2047	977.59	3.09	2047	977.46	3.49	0.4	-0.13	982	978
508+00	51150	5-yr	3336	979.95	3.78	3336	979.9	4.24	0.46	-0.05	982	978
508+00	51150	10-yr	4375	981.6	4.11	4375	981.6	4.61	0.5	0	982	978
508+00	51150	50-yr	7239	985.73	3.93	7239	985.67	4.6	0.67	-0.06	982	978
508+00	51150	100-yr	8721	987.63	3.55	8721	987.53	4.24	0.69	-0.1	982	978
508+50	51100	Avg Annual	134	971.39	0.93	134	971.32	0.96	0.03	-0.07	982	978
508+50	51100	0.125-yr	460	973.19	1.65	460	973.01	1.83	0.18	-0.18	982	978
508+50	51100	0.25-yr	976	975.03	2.26	976	974.8	2.51	0.25	-0.23	982	978
508+50	51100	0.5-yr	1422	976.21	2.64	1422	976.01	2.91	0.27	-0.2	982	978
508+50	51100	0.75-yr	1612	976.65	2.79	1612	976.48	3.06	0.27	-0.17	982	978
508+50	51100	1-yr	1670	976.78	2.83	1670	976.61	3.11	0.28	-0.17	982	978
508+50	51100	1.5-yr	1761	976.98	2.89	1761	976.82	3.17	0.28	-0.16	982	978
508+50	51100	2-yr	2047	977.58	3.08	2047	977.45	3.36	0.28	-0.13	982	978
508+50	51100	5-yr	3336	979.93	3.73	3336	979.9	4.03	0.3	-0.03	982	978
508+50	51100	10-yr	4375	981.58	4.06	4375	981.61	4.36	0.3	0.03	982	978
508+50	51100	50-yr	7239	985.71	3.92	7239	985.67	4.36	0.44	-0.04	982	978
508+50	51100	100-yr	8721	987.63	3.43	8721	987.53	4	0.57	-0.1	982	978
509+00	51050	Avg Annual	134	971.38	0.73	134	971.32	0.81	0.08	-0.06	983	977
509+00	51050	0.125-yr	460	973.19	1.47	460	973	1.68	0.21	-0.19	983	977
509+00	51050	0.25-yr	976	975.02	2.1	976	974.79	2.36	0.26	-0.23	983	977
509+00	51050	0.5-yr	1422	976.2	2.5	1422	976.01	2.76	0.26	-0.19	983	977
509+00	51050	0.75-yr	1612	976.65	2.64	1612	976.47	2.91	0.27	-0.18	983	977
509+00	51050	1-yr	1670	976.77	2.69	1670	976.6	2.95	0.26	-0.17	983	977
509+00	51050	1.5-yr	1761	976.97	2.75	1761	976.81	3.02	0.27	-0.16	983	977
509+00	51050	2-yr	2047	977.57	2.94	2047	977.44	3.21	0.27	-0.13	983	977
509+00	51050	5-yr	3336	979.93	3.59	3336	979.9	3.85	0.26	-0.03	983	977
509+00	51050	10-yr	4375	981.59	3.88	4375	981.61	4.13	0.25	0.02	983	977
509+00	51050	50-yr	7239	985.71	3.81	7239	985.64	4.43	0.62	-0.07	983	977
509+00	51050	100-yr	8721	987.61	3.48	8721	987.49	4.22	0.74	-0.12	983	977
Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.												

Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta$ El. (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
509+50	51000	Avg Annual	134	971.37	1.04	134	971.32	0.83	-0.21	-0.05	983	978
509+50	51000	0.125-yr	460	973.15	1.85	460	972.99	1.62	-0.23	-0.16	983	978
509+50	51000	0.25-yr	976	974.97	2.49	976	974.78	2.25	-0.24	-0.19	983	978
509+50	51000	0.5-yr	1422	976.15	2.89	1422	976	2.63	-0.26	-0.15	983	978
509+50	51000	0.75-yr	1612	976.59	3.04	1612	976.46	2.76	-0.28	-0.13	983	978
509+50	51000	1-yr	1670	976.72	3.08	1670	976.59	2.8	-0.28	-0.13	983	978
509+50	51000	1.5-yr	1761	976.91	3.15	1761	976.8	2.87	-0.28	-0.11	983	978
509+50	51000	2-yr	2047	977.51	3.35	2047	977.43	3.05	-0.3	-0.08	983	978
509+50	51000	5-yr	3336	979.85	4.03	3336	979.9	3.65	-0.38	0.05	983	978
509+50	51000	10-yr	4375	981.52	4.22	4375	981.62	3.87	-0.35	0.1	983	978
509+50	51000	50-yr	7239	985.66	4.19	7239	985.66	4.07	-0.12	0	983	978
509+50	51000	100-yr	8721	987.59	3.69	8721	987.5	3.85	0.16	-0.09	983	978
510+00	50950	Avg Annual	134	971.35	1.1	134	971.3	1.1	0	-0.05	982	978
510+00	50950	0.125-yr	460	973.12	1.95	460	972.95	1.99	0.04	-0.17	982	978
510+00	50950	0.25-yr	976	974.93	2.66	976	974.73	2.69	0.03	-0.2	982	978
510+00	50950	0.5-yr	1422	976.1	3.09	1422	975.93	3.1	0.01	-0.17	982	978
510+00	50950	0.75-yr	1612	976.54	3.24	1612	976.39	3.25	0.01	-0.15	982	978
510+00	50950	1-yr	1670	976.67	3.29	1670	976.52	3.29	0	-0.15	982	978
510+00	50950	1.5-yr	1761	976.86	3.36	1761	976.73	3.36	0	-0.13	982	978
510+00	50950	2-yr	2047	977.45	3.55	2047	977.35	3.56	0.01	-0.1	982	978
510+00	50950	5-yr	3336	979.8	4.22	3336	979.81	4.2	-0.02	0.01	982	978
510+00	50950	10-yr	4375	981.48	4.4	4375	981.53	4.45	0.05	0.05	982	978
510+00	50950	50-yr	7239	985.64	4.26	7239	985.59	4.55	0.29	-0.05	982	978
510+00	50950	100-yr	8721	987.56	3.93	8721	987.45	4.32	0.39	-0.11	982	978
510+50	50900	Avg Annual	134	971.32	1.32	134	971.29	1.05	-0.27	-0.03	982	978
510+50	50900	0.125-yr	460	973.06	2.32	460	972.93	1.92	-0.4	-0.13	982	978
510+50	50900	0.25-yr	976	974.85	3.07	976	974.71	2.63	-0.44	-0.14	982	978
510+50	50900	0.5-yr	1422	976.02	3.52	1422	975.91	3.05	-0.47	-0.11	982	978
510+50	50900	0.75-yr	1612	976.45	3.69	1612	976.37	3.2	-0.49	-0.08	982	978
510+50	50900	1-yr	1670	976.58	3.74	1670	976.5	3.24	-0.5	-0.08	982	978
510+50	50900	1.5-yr	1761	976.77	3.81	1761	976.71	3.31	-0.5	-0.06	982	978
510+50	50900	2-yr	2047	977.35	4.04	2047	977.34	3.51	-0.53	-0.01	982	978
510+50	50900	5-yr	3336	979.67	4.86	3336	979.79	4.16	-0.7	0.12	982	978
510+50	50900	10-yr	4375	981.35	5.03	4375	981.51	4.39	-0.64	0.16	982	978
510+50	50900	50-yr	7239	985.52	5	7239	985.58	4.54	-0.46	0.06	982	978
510+50	50900	100-yr	8721	987.46	4.71	8721	987.43	4.41	-0.3	-0.03	982	978

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.

Table C-1 Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta El.$ (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
511+00	50850	Avg Annual	134	971.31	1.01	134	971.28	0.92	-0.09	-0.03	984	978
511+00	50850	0.125-yr	460	973.05	1.93	460	972.92	1.92	-0.01	-0.13	984	978
511+00	50850	0.25-yr	976	974.83	2.65	976	974.67	2.74	0.09	-0.16	984	978
511+00	50850	0.5-yr	1422	976	3.06	1422	975.87	3.21	0.15	-0.13	984	978
511+00	50850	0.75-yr	1612	976.44	3.22	1612	976.33	3.38	0.16	-0.11	984	978
511+00	50850	1-yr	1670	976.56	3.26	1670	976.46	3.43	0.17	-0.1	984	978
511+00	50850	1.5-yr	1761	976.76	3.33	1761	976.67	3.5	0.17	-0.09	984	978
511+00	50850	2-yr	2047	977.35	3.53	2047	977.29	3.72	0.19	-0.06	984	978
511+00	50850	5-yr	3336	979.71	4.03	3336	979.77	4.21	0.18	0.06	984	978
511+00	50850	10-yr	4375	981.4	4.15	4375	981.51	4.38	0.23	0.11	984	978
511+00	50850	50-yr	7239	985.58	4.05	7239	985.57	4.63	0.58	-0.01	984	978
511+00	50850	100-yr	8721	987.5	3.83	8721	987.41	4.56	0.73	-0.09	984	978
511+50	50800	Avg Annual	134	971.3	1.03	134	971.27	1.14	0.11	-0.03	981	980
511+50	50800	0.125-yr	460	973.02	1.86	460	972.89	2.08	0.22	-0.13	981	980
511+50	50800	0.25-yr	976	974.8	2.54	976	974.64	2.82	0.28	-0.16	981	980
511+50	50800	0.5-yr	1422	975.97	2.96	1422	975.84	3.26	0.3	-0.13	981	980
511+50	50800	0.75-yr	1612	976.4	3.12	1612	976.3	3.42	0.3	-0.1	981	980
511+50	50800	1-yr	1670	976.53	3.17	1670	976.43	3.47	0.3	-0.1	981	980
511+50	50800	1.5-yr	1761	976.72	3.24	1761	976.64	3.54	0.3	-0.08	981	980
511+50	50800	2-yr	2047	977.31	3.45	2047	977.26	3.75	0.3	-0.05	981	980
511+50	50800	5-yr	3336	979.63	4.19	3336	979.69	4.49	0.3	0.06	981	980
511+50	50800	10-yr	4375	981.3	4.51	4375	981.41	4.77	0.26	0.11	981	980
511+50	50800	50-yr	7239	985.47	4.59	7239	985.49	4.94	0.35	0.02	981	980
511+50	50800	100-yr	8721	987.41	4.36	8721	987.35	4.8	0.44	-0.06	981	980
512+00	50750	Avg Annual	134	971.28	1.05	134	971.26	1.02	-0.03	-0.02	981	979
512+00	50750	0.125-yr	460	972.99	1.88	460	972.87	2.01	0.13	-0.12	981	979
512+00	50750	0.25-yr	976	974.76	2.59	976	974.62	2.81	0.22	-0.14	981	979
512+00	50750	0.5-yr	1422	975.92	3.03	1422	975.81	3.29	0.26	-0.11	981	979
512+00	50750	0.75-yr	1612	976.35	3.2	1612	976.26	3.46	0.26	-0.09	981	979
512+00	50750	1-yr	1670	976.48	3.25	1670	976.4	3.51	0.26	-0.08	981	979
512+00	50750	1.5-yr	1761	976.68	3.33	1761	976.6	3.59	0.26	-0.08	981	979
512+00	50750	2-yr	2047	977.26	3.55	2047	977.22	3.82	0.27	-0.04	981	979
512+00	50750	5-yr	3336	979.57	4.35	3336	979.64	4.65	0.3	0.07	981	979
512+00	50750	10-yr	4375	981.21	4.8	4375	981.32	5.08	0.28	0.11	981	979
512+00	50750	50-yr	7239	985.44	4.69	7239	985.43	5.21	0.52	-0.01	981	979
512+00	50750	100-yr	8721	987.4	4.35	8721	987.32	4.97	0.62	-0.08	981	979
Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.												

Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta El.$ (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
512+50	50700	Avg Annual	134	971.27	0.89	134	971.24	1.36	0.47	-0.03	980	982.12
512+50	50700	0.125-yr	460	972.97	1.81	460	972.81	2.46	0.65	-0.16	980	982.12
512+50	50700	0.25-yr	976	974.73	2.56	976	974.55	3.17	0.61	-0.18	980	982.12
512+50	50700	0.5-yr	1422	975.89	3.01	1422	975.74	3.6	0.59	-0.15	980	982.12
512+50	50700	0.75-yr	1612	976.32	3.18	1612	976.2	3.75	0.57	-0.12	980	982.12
512+50	50700	1-yr	1670	976.45	3.23	1670	976.33	3.79	0.56	-0.12	980	982.12
512+50	50700	1.5-yr	1761	976.65	3.3	1761	976.54	3.86	0.56	-0.11	980	982.12
512+50	50700	2-yr	2047	977.23	3.53	2047	977.16	4.05	0.52	-0.07	980	982.12
512+50	50700	5-yr	3336	979.54	4.28	3336	979.6	4.74	0.46	0.06	980	982.12
512+50	50700	10-yr	4375	981.19	4.73	4375	981.3	5.1	0.37	0.11	980	982.12
512+50	50700	50-yr	7239	985.34	5.05	7239	985.36	5.49	0.44	0.02	980	982.12
512+50	50700	100-yr	8721	987.29	4.93	8721	987.22	5.43	0.5	-0.07	980	982.12
513+00	50650	Avg Annual	134	971.27	0.76	134	971.24	0.79	0.03	-0.03	983	982.66
513+00	50650	0.125-yr	460	972.95	1.65	460	972.82	1.74	0.09	-0.13	983	982.66
513+00	50650	0.25-yr	976	974.71	2.45	976	974.56	2.57	0.12	-0.15	983	982.66
513+00	50650	0.5-yr	1422	975.86	2.95	1422	975.75	3.06	0.11	-0.11	983	982.66
513+00	50650	0.75-yr	1612	976.3	3.14	1612	976.21	3.24	0.1	-0.09	983	982.66
513+00	50650	1-yr	1670	976.42	3.19	1670	976.34	3.3	0.11	-0.08	983	982.66
513+00	50650	1.5-yr	1761	976.62	3.27	1761	976.55	3.38	0.11	-0.07	983	982.66
513+00	50650	2-yr	2047	977.2	3.5	2047	977.17	3.61	0.11	-0.03	983	982.66
513+00	50650	5-yr	3336	979.52	4.27	3336	979.61	4.4	0.13	0.09	983	982.66
513+00	50650	10-yr	4375	981.15	4.77	4375	981.29	4.85	0.08	0.14	983	982.66
513+00	50650	50-yr	7239	985.32	5.15	7239	985.35	5.33	0.18	0.03	983	982.66
513+00	50650	100-yr	8721	987.28	4.91	8721	987.22	5.24	0.33	-0.06	983	982.66
513+50	50600	Avg Annual	134	971.25	0.88	134	971.23	1.06	0.18	-0.02	982	981
513+50	50600	0.125-yr	460	972.92	1.77	460	972.78	2.05	0.28	-0.14	982	981
513+50	50600	0.25-yr	976	974.68	2.47	976	974.52	2.75	0.28	-0.16	982	981
513+50	50600	0.5-yr	1422	975.83	2.87	1422	975.72	3.11	0.24	-0.11	982	981
513+50	50600	0.75-yr	1612	976.27	3.02	1612	976.19	3.24	0.22	-0.08	982	981
513+50	50600	1-yr	1670	976.39	3.07	1670	976.32	3.28	0.21	-0.07	982	981
513+50	50600	1.5-yr	1761	976.59	3.13	1761	976.53	3.34	0.21	-0.06	982	981
513+50	50600	2-yr	2047	977.17	3.33	2047	977.15	3.52	0.19	-0.02	982	981
513+50	50600	5-yr	3336	979.49	4.02	3336	979.61	4.15	0.13	0.12	982	981
513+50	50600	10-yr	4375	981.13	4.46	4375	981.3	4.52	0.06	0.17	982	981
513+50	50600	50-yr	7239	985.34	4.53	7239	985.39	4.71	0.18	0.05	982	981
513+50	50600	100-yr	8721	987.3	4.29	8721	987.26	4.6	0.31	-0.04	982	981

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.

Table C-1												
Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta$ El. (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
514+00	50550	Avg Annual	134	971.24	0.92	134	971.23	0.65	-0.27	-0.01	984.1	981
514+00	50550	0.125-yr	460	972.89	1.9	460	972.79	1.44	-0.46	-0.1	984.1	981
514+00	50550	0.25-yr	976	974.62	2.72	976	974.53	2.12	-0.6	-0.09	984.1	981
514+00	50550	0.5-yr	1422	975.77	3.22	1422	975.74	2.54	-0.68	-0.03	984.1	981
514+00	50550	0.75-yr	1612	976.19	3.4	1612	976.2	2.7	-0.7	0.01	984.1	981
514+00	50550	1-yr	1670	976.32	3.45	1670	976.33	2.74	-0.71	0.01	984.1	981
514+00	50550	1.5-yr	1761	976.51	3.53	1761	976.54	2.81	-0.72	0.03	984.1	981
514+00	50550	2-yr	2047	977.09	3.77	2047	977.17	3	-0.77	0.08	984.1	981
514+00	50550	5-yr	3336	979.39	4.53	3336	979.62	3.7	-0.83	0.23	984.1	981
514+00	50550	10-yr	4375	981.08	4.8	4375	981.33	4.01	-0.79	0.25	984.1	981
514+00	50550	50-yr	7239	985.42	3.66	7239	985.51	3.27	-0.39	0.09	984.1	981
514+00	50550	100-yr	8721	987.4	2.79	8721	987.39	2.65	-0.14	-0.01	984.1	981
514+50	50500	Avg Annual	134	971.24	0.89	134	971.22	0.93	0.04	-0.02	986.7	981
514+50	50500	0.125-yr	460	972.87	1.86	460	972.74	1.99	0.13	-0.13	986.7	981
514+50	50500	0.25-yr	976	974.59	2.66	976	974.45	2.85	0.19	-0.14	986.7	981
514+50	50500	0.5-yr	1422	975.73	3.14	1422	975.63	3.33	0.19	-0.1	986.7	981
514+50	50500	0.75-yr	1612	976.16	3.32	1612	976.08	3.5	0.18	-0.08	986.7	981
514+50	50500	1-yr	1670	976.29	3.37	1670	976.22	3.55	0.18	-0.07	986.7	981
514+50	50500	1.5-yr	1761	976.48	3.45	1761	976.42	3.62	0.17	-0.06	986.7	981
514+50	50500	2-yr	2047	977.06	3.69	2047	977.04	3.83	0.14	-0.02	986.7	981
514+50	50500	5-yr	3336	979.36	4.47	3336	979.47	4.5	0.03	0.11	986.7	981
514+50	50500	10-yr	4375	981.03	4.8	4375	981.19	4.68	-0.12	0.16	986.7	981
514+50	50500	50-yr	7239	985.39	3.74	7239	985.49	3.26	-0.48	0.1	986.7	981
514+50	50500	100-yr	8721	987.39	2.85	8721	987.38	2.52	-0.33	-0.01	986.7	981
515+00	50450	Avg Annual	134	971.22	1.12	134	971.21	0.86	-0.26	-0.01	986.87	981
515+00	50450	0.125-yr	460	972.83	2.11	460	972.72	1.93	-0.18	-0.11	986.87	981
515+00	50450	0.25-yr	976	974.53	2.9	976	974.41	2.85	-0.05	-0.12	986.87	981
515+00	50450	0.5-yr	1422	975.67	3.38	1422	975.58	3.38	0	-0.09	986.87	981
515+00	50450	0.75-yr	1612	976.09	3.56	1612	976.03	3.56	0	-0.06	986.87	981
515+00	50450	1-yr	1670	976.22	3.61	1670	976.16	3.62	0.01	-0.06	986.87	981
515+00	50450	1.5-yr	1761	976.41	3.69	1761	976.37	3.69	0	-0.04	986.87	981
515+00	50450	2-yr	2047	976.98	3.93	2047	976.98	3.92	-0.01	0	986.87	981
515+00	50450	5-yr	3336	979.27	4.73	3336	979.39	4.74	0.01	0.12	986.87	981
515+00	50450	10-yr	4375	980.94	5.09	4375	981.08	5.13	0.04	0.14	986.87	981
515+00	50450	50-yr	7239	985.24	4.68	7239	985.31	4.71	0.03	0.07	986.87	981
515+00	50450	100-yr	8721	987.31	3.66	8721	987.29	3.72	0.06	-0.02	986.87	981

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.

Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta El.$ (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
515+50	50400	Avg Annual	134	971.21	0.82	134	971.21	0.65	-0.17	0	987	980
515+50	50400	0.125-yr	460	972.82	1.74	460	972.72	1.54	-0.2	-0.1	987	980
515+50	50400	0.25-yr	976	974.52	2.56	976	974.42	2.35	-0.21	-0.1	987	980
515+50	50400	0.5-yr	1422	975.66	3.07	1422	975.59	2.83	-0.24	-0.07	987	980
515+50	50400	0.75-yr	1612	976.08	3.26	1612	976.04	3	-0.26	-0.04	987	980
515+50	50400	1-yr	1670	976.2	3.31	1670	976.17	3.05	-0.26	-0.03	987	980
515+50	50400	1.5-yr	1761	976.39	3.4	1761	976.38	3.12	-0.28	-0.01	987	980
515+50	50400	2-yr	2047	976.97	3.65	2047	976.99	3.33	-0.32	0.02	987	980
515+50	50400	5-yr	3336	979.25	4.53	3336	979.42	4.03	-0.5	0.17	987	980
515+50	50400	10-yr	4375	980.9	5.03	4375	981.11	4.41	-0.62	0.21	987	980
515+50	50400	50-yr	7239	985.06	5.45	7239	985.28	4.43	-1.02	0.22	987	980
515+50	50400	100-yr	8721	987.12	4.93	8721	987.2	4.08	-0.85	0.08	987	980
516+00	50350	Avg Annual	134	971.2	0.95	134	971.21	0.64	-0.31	0.01	989	981
516+00	50350	0.125-yr	460	972.79	1.94	460	972.71	1.54	-0.4	-0.08	989	981
516+00	50350	0.25-yr	976	974.47	2.75	976	974.39	2.37	-0.38	-0.08	989	981
516+00	50350	0.5-yr	1422	975.61	3.21	1422	975.56	2.86	-0.35	-0.05	989	981
516+00	50350	0.75-yr	1612	976.03	3.39	1612	976.01	3.03	-0.36	-0.02	989	981
516+00	50350	1-yr	1670	976.15	3.44	1670	976.14	3.08	-0.36	-0.01	989	981
516+00	50350	1.5-yr	1761	976.35	3.51	1761	976.35	3.15	-0.36	0	989	981
516+00	50350	2-yr	2047	976.92	3.74	2047	976.96	3.37	-0.37	0.04	989	981
516+00	50350	5-yr	3336	979.21	4.54	3336	979.37	4.08	-0.46	0.16	989	981
516+00	50350	10-yr	4375	980.86	5.02	4375	981.06	4.48	-0.54	0.2	989	981
516+00	50350	50-yr	7239	985.03	5.41	7239	985.18	4.83	-0.58	0.15	989	981
516+00	50350	100-yr	8721	987.12	4.76	8721	987.15	4.31	-0.45	0.03	989	981
516+50	50300	Avg Annual	134	971.2	0.88	134	971.21	0.68	-0.2	0.01	990.05	982
516+50	50300	0.125-yr	460	972.76	1.98	460	972.69	1.68	-0.3	-0.07	990.05	982
516+50	50300	0.25-yr	976	974.42	2.95	976	974.35	2.62	-0.33	-0.07	990.05	982
516+50	50300	0.5-yr	1422	975.53	3.52	1422	975.5	3.18	-0.34	-0.03	990.05	982
516+50	50300	0.75-yr	1612	975.94	3.74	1612	975.94	3.38	-0.36	0	990.05	982
516+50	50300	1-yr	1670	976.07	3.8	1670	976.07	3.43	-0.37	0	990.05	982
516+50	50300	1.5-yr	1761	976.26	3.89	1761	976.27	3.52	-0.37	0.01	990.05	982
516+50	50300	2-yr	2047	976.82	4.17	2047	976.88	3.76	-0.41	0.06	990.05	982
516+50	50300	5-yr	3336	979.07	5.15	3336	979.26	4.56	-0.59	0.19	990.05	982
516+50	50300	10-yr	4375	980.69	5.71	4375	980.93	5	-0.71	0.24	990.05	982
516+50	50300	50-yr	7239	984.73	6.65	7239	984.98	5.67	-0.98	0.25	990.05	982
516+50	50300	100-yr	8721	986.79	6.38	8721	986.94	5.42	-0.96	0.15	990.05	982

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.

Table C-1 Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta$ El. (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
517+00	50250	Avg Annual	134	971.19	0.85	134	971.21	0.66	-0.19	0.02	989.9	983
517+00	50250	0.125-yr	460	972.74	1.97	460	972.68	1.67	-0.3	-0.06	989.9	983
517+00	50250	0.25-yr	976	974.37	3.03	976	974.32	2.67	-0.36	-0.05	989.9	983
517+00	50250	0.5-yr	1422	975.47	3.68	1422	975.46	3.26	-0.42	-0.01	989.9	983
517+00	50250	0.75-yr	1612	975.87	3.92	1612	975.9	3.47	-0.45	0.03	989.9	983
517+00	50250	1-yr	1670	976	4	1670	976.03	3.53	-0.47	0.03	989.9	983
517+00	50250	1.5-yr	1761	976.18	4.1	1761	976.22	3.62	-0.48	0.04	989.9	983
517+00	50250	2-yr	2047	976.73	4.42	2047	976.82	3.89	-0.53	0.09	989.9	983
517+00	50250	5-yr	3336	978.95	5.53	3336	979.18	4.76	-0.77	0.23	989.9	983
517+00	50250	10-yr	4375	980.55	6.17	4375	980.84	5.27	-0.9	0.29	989.9	983
517+00	50250	50-yr	7239	984.67	6.89	7239	984.86	6.11	-0.78	0.19	989.9	983
517+00	50250	100-yr	8721	986.82	6.16	8721	986.86	5.76	-0.4	0.04	989.9	983
517+50	50200	Avg Annual	134	971.18	0.86	134	971.2	0.72	-0.14	0.02	989.59	983
517+50	50200	0.125-yr	460	972.72	1.9	460	972.66	1.79	-0.11	-0.06	989.59	983
517+50	50200	0.25-yr	976	974.35	2.85	976	974.28	2.84	-0.01	-0.07	989.59	983
517+50	50200	0.5-yr	1422	975.44	3.42	1422	975.4	3.46	0.04	-0.04	989.59	983
517+50	50200	0.75-yr	1612	975.85	3.64	1612	975.83	3.68	0.04	-0.02	989.59	983
517+50	50200	1-yr	1670	975.98	3.7	1670	975.96	3.75	0.05	-0.02	989.59	983
517+50	50200	1.5-yr	1761	976.16	3.8	1761	976.16	3.84	0.04	0	989.59	983
517+50	50200	2-yr	2047	976.72	4.08	2047	976.74	4.12	0.04	0.02	989.59	983
517+50	50200	5-yr	3336	978.95	5.06	3336	979.09	5.01	-0.05	0.14	989.59	983
517+50	50200	10-yr	4375	980.56	5.63	4375	980.75	5.48	-0.15	0.19	989.59	983
517+50	50200	50-yr	7239	984.65	6.56	7239	984.78	6.17	-0.39	0.13	989.59	983
517+50	50200	100-yr	8721	986.59	6.71	8721	986.72	6.07	-0.64	0.13	989.59	983
518+00	50150	Avg Annual	134	971.18	0.85	134	971.2	0.62	-0.23	0.02	990	984
518+00	50150	0.125-yr	460	972.7	1.84	460	972.66	1.55	-0.29	-0.04	990	984
518+00	50150	0.25-yr	976	974.32	2.74	976	974.28	2.49	-0.25	-0.04	990	984
518+00	50150	0.5-yr	1422	975.41	3.29	1422	975.4	3.05	-0.24	-0.01	990	984
518+00	50150	0.75-yr	1612	975.83	3.49	1612	975.83	3.26	-0.23	0	990	984
518+00	50150	1-yr	1670	975.95	3.55	1670	975.96	3.31	-0.24	0.01	990	984
518+00	50150	1.5-yr	1761	976.13	3.64	1761	976.15	3.4	-0.24	0.02	990	984
518+00	50150	2-yr	2047	976.69	3.91	2047	976.74	3.66	-0.25	0.05	990	984
518+00	50150	5-yr	3336	978.93	4.84	3336	979.09	4.55	-0.29	0.16	990	984
518+00	50150	10-yr	4375	980.55	5.38	4375	980.75	5.08	-0.3	0.2	990	984
518+00	50150	50-yr	7239	984.62	6.39	7239	984.76	6.07	-0.32	0.14	990	984
518+00	50150	100-yr	8721	986.59	6.45	8721	986.68	6.18	-0.27	0.09	990	984

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.

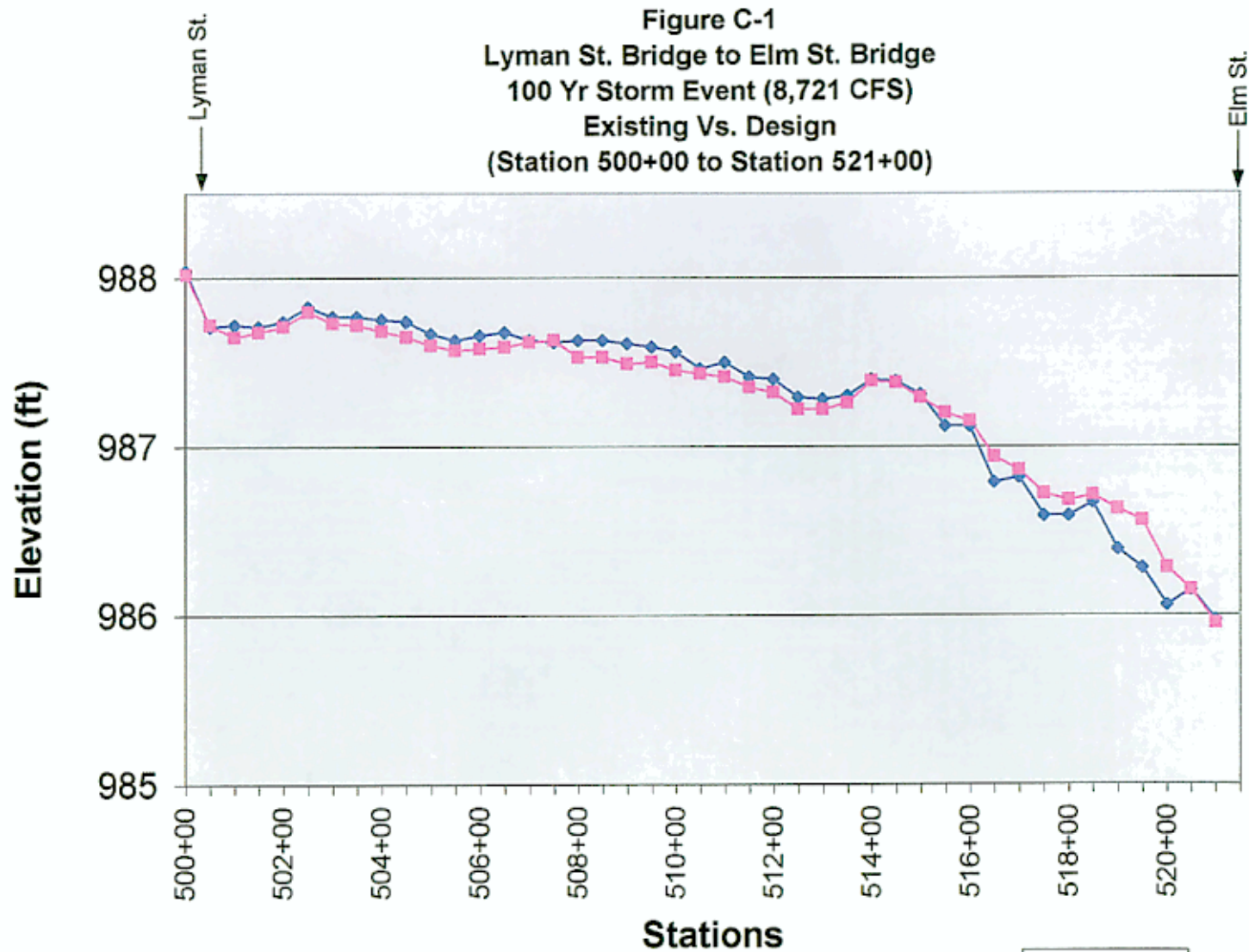
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta$ El. (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
518+50	50100	Avg Annual	134	971.17	0.78	134	971.2	0.58	-0.2	0.03	988	983
518+50	50100	0.125-yr	460	972.69	1.68	460	972.66	1.44	-0.24	-0.03	988	983
518+50	50100	0.25-yr	976	974.31	2.48	976	974.27	2.26	-0.22	-0.04	988	983
518+50	50100	0.5-yr	1422	975.4	2.94	1422	975.39	2.76	-0.18	-0.01	988	983
518+50	50100	0.75-yr	1612	975.82	3.11	1612	975.83	2.93	-0.18	0.01	988	983
518+50	50100	1-yr	1670	975.94	3.16	1670	975.95	2.98	-0.18	0.01	988	983
518+50	50100	1.5-yr	1761	976.13	3.23	1761	976.15	3.06	-0.17	0.02	988	983
518+50	50100	2-yr	2047	976.69	3.45	2047	976.74	3.28	-0.17	0.05	988	983
518+50	50100	5-yr	3336	978.95	4.21	3336	979.1	4.07	-0.14	0.15	988	983
518+50	50100	10-yr	4375	980.59	4.64	4375	980.77	4.54	-0.1	0.18	988	983
518+50	50100	50-yr	7239	984.71	5.38	7239	984.81	5.43	0.05	0.1	988	983
518+50	50100	100-yr	8721	986.67	5.49	8721	986.71	5.62	0.13	0.04	988	983
519+00	50050	Avg Annual	134	971.15	1.13	134	971.19	0.78	-0.35	0.04	984.56	986
519+00	50050	0.125-yr	460	972.63	2.29	460	972.63	1.75	-0.54	0	984.56	986
519+00	50050	0.25-yr	976	974.2	3.24	976	974.22	2.6	-0.64	0.02	984.56	986
519+00	50050	0.5-yr	1422	975.27	3.77	1422	975.33	3.09	-0.68	0.06	984.56	986
519+00	50050	0.75-yr	1612	975.67	3.96	1612	975.76	3.26	-0.7	0.09	984.56	986
519+00	50050	1-yr	1670	975.79	4.02	1670	975.89	3.31	-0.71	0.1	984.56	986
519+00	50050	1.5-yr	1761	975.97	4.1	1761	976.08	3.38	-0.72	0.11	984.56	986
519+00	50050	2-yr	2047	976.53	4.34	2047	976.67	3.59	-0.75	0.14	984.56	986
519+00	50050	5-yr	3336	978.75	5.16	3336	979.03	4.34	-0.82	0.28	984.56	986
519+00	50050	10-yr	4375	980.38	5.6	4375	980.7	4.79	-0.81	0.32	984.56	986
519+00	50050	50-yr	7239	984.48	6.38	7239	984.73	5.66	-0.72	0.25	984.56	986
519+00	50050	100-yr	8721	986.39	6.68	8721	986.63	5.9	-0.78	0.24	984.56	986
519+50	50000	Avg Annual	134	971.11	1.58	134	971.18	0.91	-0.67	0.07	985.1	986
519+50	50000	0.125-yr	460	972.51	2.92	460	972.57	2	-0.92	0.06	985.1	986
519+50	50000	0.25-yr	976	974.04	3.91	976	974.12	2.93	-0.98	0.08	985.1	986
519+50	50000	0.5-yr	1422	975.1	4.44	1422	975.21	3.45	-0.99	0.11	985.1	986
519+50	50000	0.75-yr	1612	975.5	4.64	1612	975.64	3.63	-1.01	0.14	985.1	986
519+50	50000	1-yr	1670	975.61	4.7	1670	975.76	3.68	-1.02	0.15	985.1	986
519+50	50000	1.5-yr	1761	975.8	4.78	1761	975.95	3.76	-1.02	0.15	985.1	986
519+50	50000	2-yr	2047	976.34	5.04	2047	976.54	3.98	-1.06	0.2	985.1	986
519+50	50000	5-yr	3336	978.56	5.88	3336	978.89	4.66	-1.22	0.33	985.1	986
519+50	50000	10-yr	4375	980.19	6.3	4375	980.67	5.01	-1.29	0.38	985.1	986
519+50	50000	50-yr	7239	984.35	6.91	7239	984.65	5.52	-1.39	0.3	985.1	986
519+50	50000	100-yr	8721	986.28	7.13	8721	986.56	5.66	-1.47	0.28	985.1	986

Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.



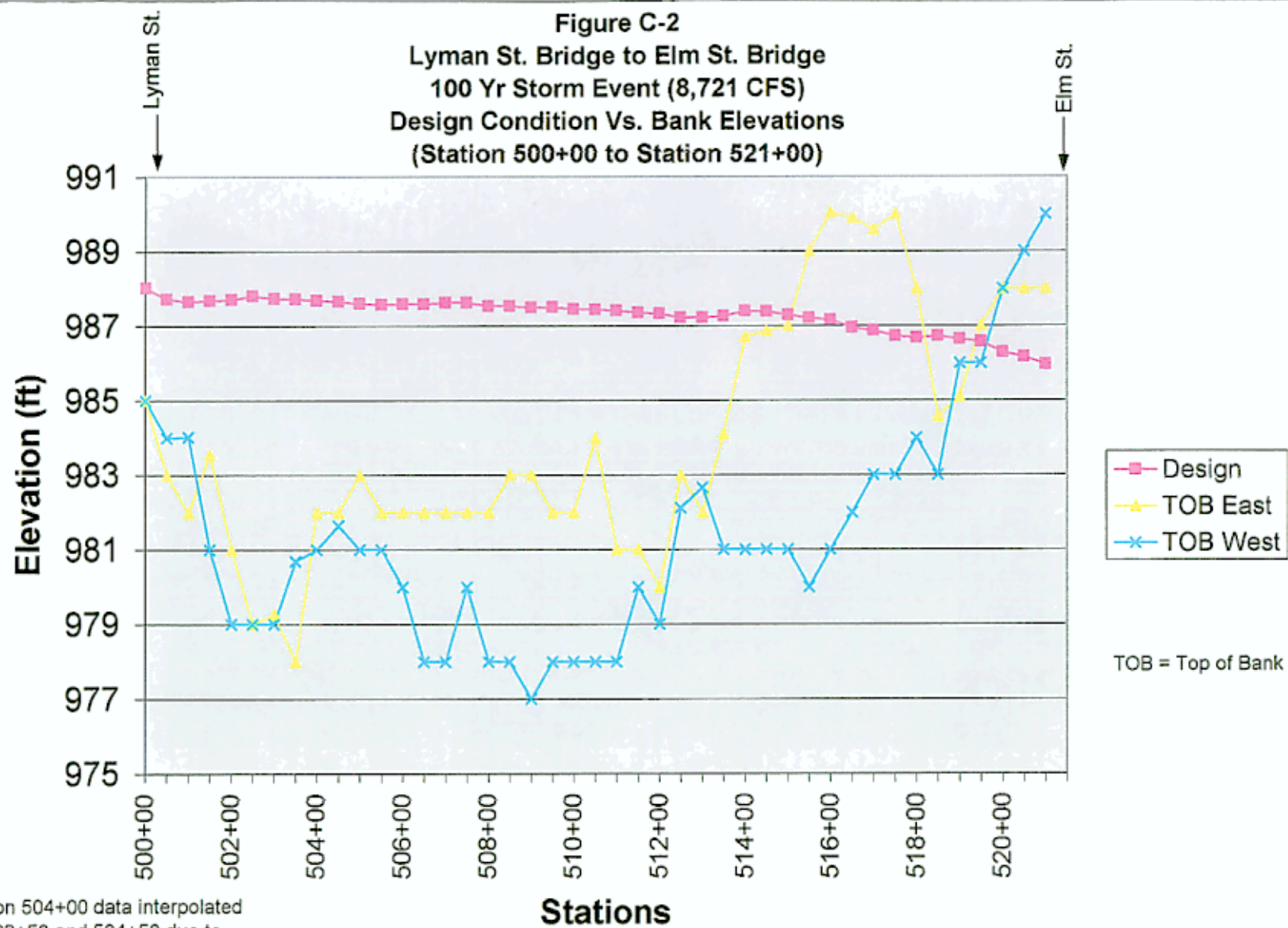
Table C-1 Summary of HEC-RAS Predictions for Changes in Water Surface Elevations and Velocities for Lyman St. to Elm St												
Station	Rvr. Sta.	Profile	Existing			Design			$\Delta V$ (fps)	$\Delta$ El. (ft)	TOB El. East	TOB El. West
			Q (cfs)	El. (ft)	V (fps)	Q (cfs)	El. (ft)	V (fps)				
520+00	49950	Avg Annual	134	971.09	1.28	134	971.16	0.98	-0.3	0.07	987.01	988
520+00	49950	0.125-yr	460	972.47	2.58	460	972.52	2.2	-0.38	0.05	987.01	988
520+00	49950	0.25-yr	976	973.98	3.64	976	974.04	3.29	-0.35	0.06	987.01	988
520+00	49950	0.5-yr	1422	975.03	4.24	1422	975.1	3.93	-0.31	0.07	987.01	988
520+00	49950	0.75-yr	1612	975.43	4.45	1612	975.51	4.14	-0.31	0.08	987.01	988
520+00	49950	1-yr	1670	975.55	4.51	1670	975.63	4.21	-0.3	0.08	987.01	988
520+00	49950	1.5-yr	1761	975.73	4.61	1761	975.81	4.3	-0.31	0.08	987.01	988
520+00	49950	2-yr	2047	976.27	4.89	2047	976.38	4.57	-0.32	0.11	987.01	988
520+00	49950	5-yr	3336	978.48	5.87	3336	978.68	5.4	-0.47	0.2	987.01	988
520+00	49950	10-yr	4375	980.08	6.42	4375	980.34	5.77	-0.65	0.26	987.01	988
520+00	49950	50-yr	7239	984.16	7.36	7239	984.4	6.43	-0.93	0.24	987.01	988
520+00	49950	100-yr	8721	986.06	7.7	8721	986.28	6.7	-1	0.22	987.01	988
520+50	49900	Avg Annual	134	971.08	0.93	134	971.15	0.95	0.02	0.07	988	989
520+50	49900	0.125-yr	460	972.46	2.02	460	972.49	2.18	0.16	0.03	988	989
520+50	49900	0.25-yr	976	973.98	2.98	976	973.97	3.31	0.33	-0.01	988	989
520+50	49900	0.5-yr	1422	975.03	3.53	1422	975.02	3.98	0.45	-0.01	988	989
520+50	49900	0.75-yr	1612	975.43	3.73	1612	975.42	4.2	0.47	-0.01	988	989
520+50	49900	1-yr	1670	975.55	3.78	1670	975.54	4.27	0.49	-0.01	988	989
520+50	49900	1.5-yr	1761	975.74	3.87	1761	975.72	4.37	0.5	-0.02	988	989
520+50	49900	2-yr	2047	976.29	4.12	2047	976.29	4.65	0.53	0	988	989
520+50	49900	5-yr	3336	978.51	5	3336	978.55	5.54	0.54	0.04	988	989
520+50	49900	10-yr	4375	980.14	5.51	4375	980.18	6	0.49	0.04	988	989
520+50	49900	50-yr	7239	984.24	6.4	7239	984.25	6.63	0.23	0.01	988	989
520+50	49900	100-yr	8721	986.15	6.73	8721	986.15	6.79	0.06	0	988	989
521+00	49850	Avg Annual	134	971.06	1.18	134	971.13	1.1	-0.08	0.07	988	990
521+00	49850	0.125-yr	460	972.39	2.42	460	972.42	2.43	0.01	0.03	988	990
521+00	49850	0.25-yr	976	973.87	3.45	976	973.87	3.6	0.15	0	988	990
521+00	49850	0.5-yr	1422	974.9	4.04	1422	974.89	4.27	0.23	-0.01	988	990
521+00	49850	0.75-yr	1612	975.3	4.25	1612	975.29	4.51	0.26	-0.01	988	990
521+00	49850	1-yr	1670	975.41	4.31	1670	975.41	4.57	0.26	0	988	990
521+00	49850	1.5-yr	1761	975.59	4.4	1761	975.59	4.67	0.27	0	988	990
521+00	49850	2-yr	2047	976.14	4.65	2047	976.14	4.95	0.3	0	988	990
521+00	49850	5-yr	3336	978.35	5.55	3336	978.38	5.83	0.28	0.03	988	990
521+00	49850	10-yr	4375	979.96	6.06	4375	980	6.26	0.2	0.04	988	990
521+00	49850	50-yr	7239	984.06	6.95	7239	984.07	6.94	-0.01	0.01	988	990
521+00	49850	100-yr	8721	985.97	7.28	8721	985.95	7.21	-0.07	-0.02	988	990
Note: Lyman St. bridge is located at Station 499+75. Elm St bridge (upstream face) is located at approximately station 521+68.												

**Figure C-1**  
**Lyman St. Bridge to Elm St. Bridge**  
**100 Yr Storm Event (8,721 CFS)**  
**Existing Vs. Design**  
**(Station 500+00 to Station 521+00)**

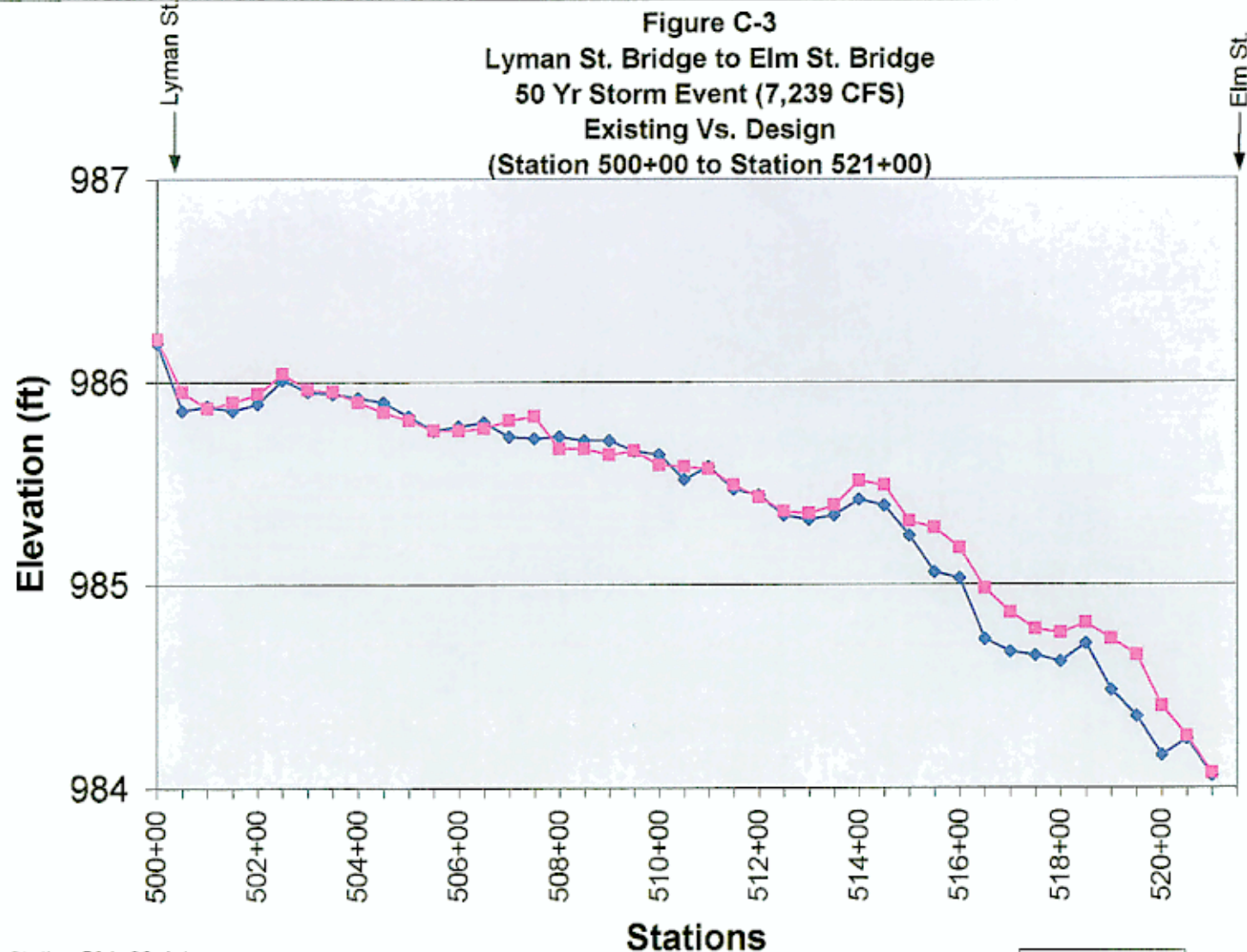


Note: Station 504+00 data interpolated  
between 503+50 and 504+50 due to  
drainage ditch

Existing  
Design

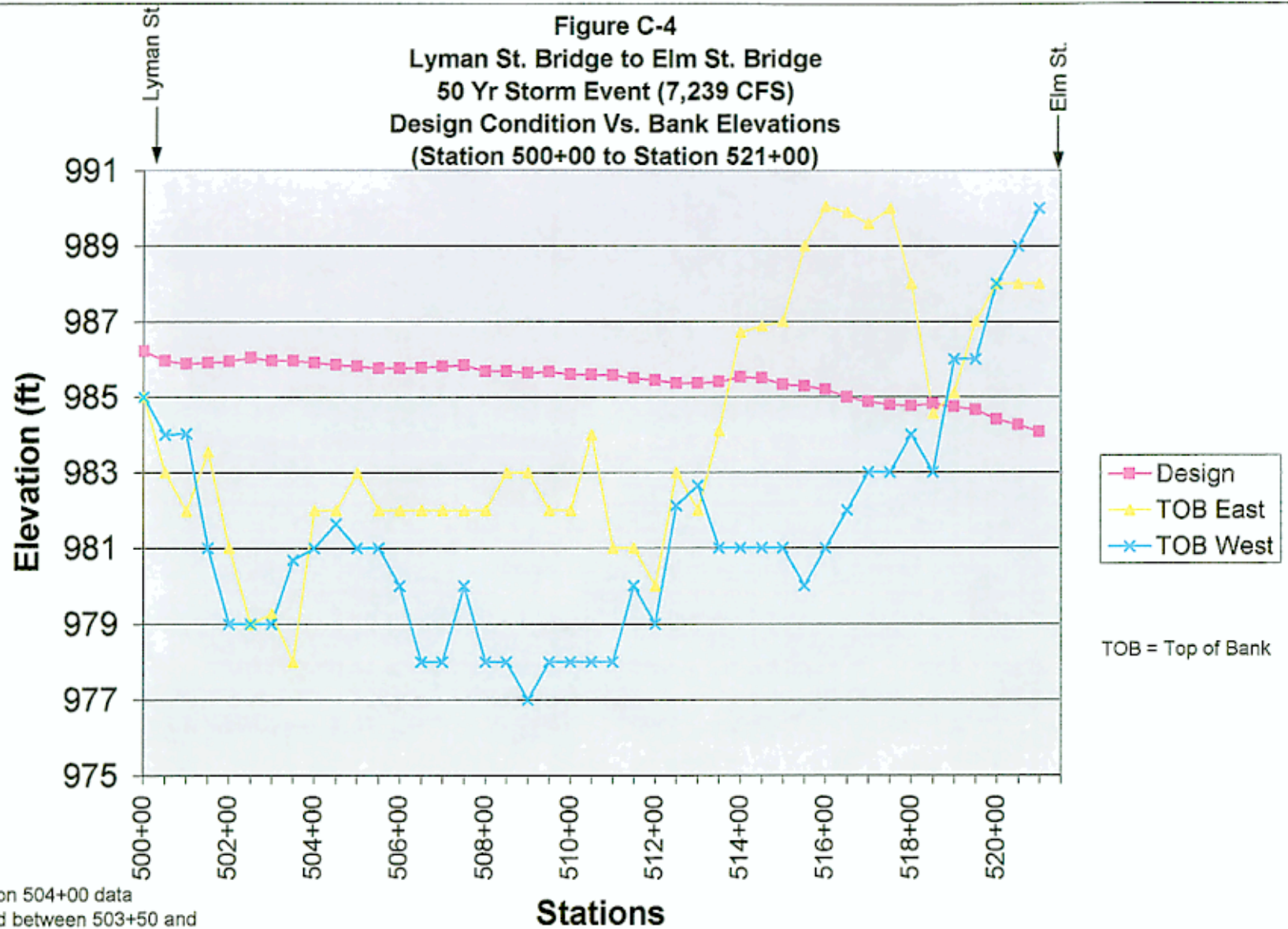


Note: Station 504+00 data interpolated between 503+50 and 504+50 due to drainage ditch

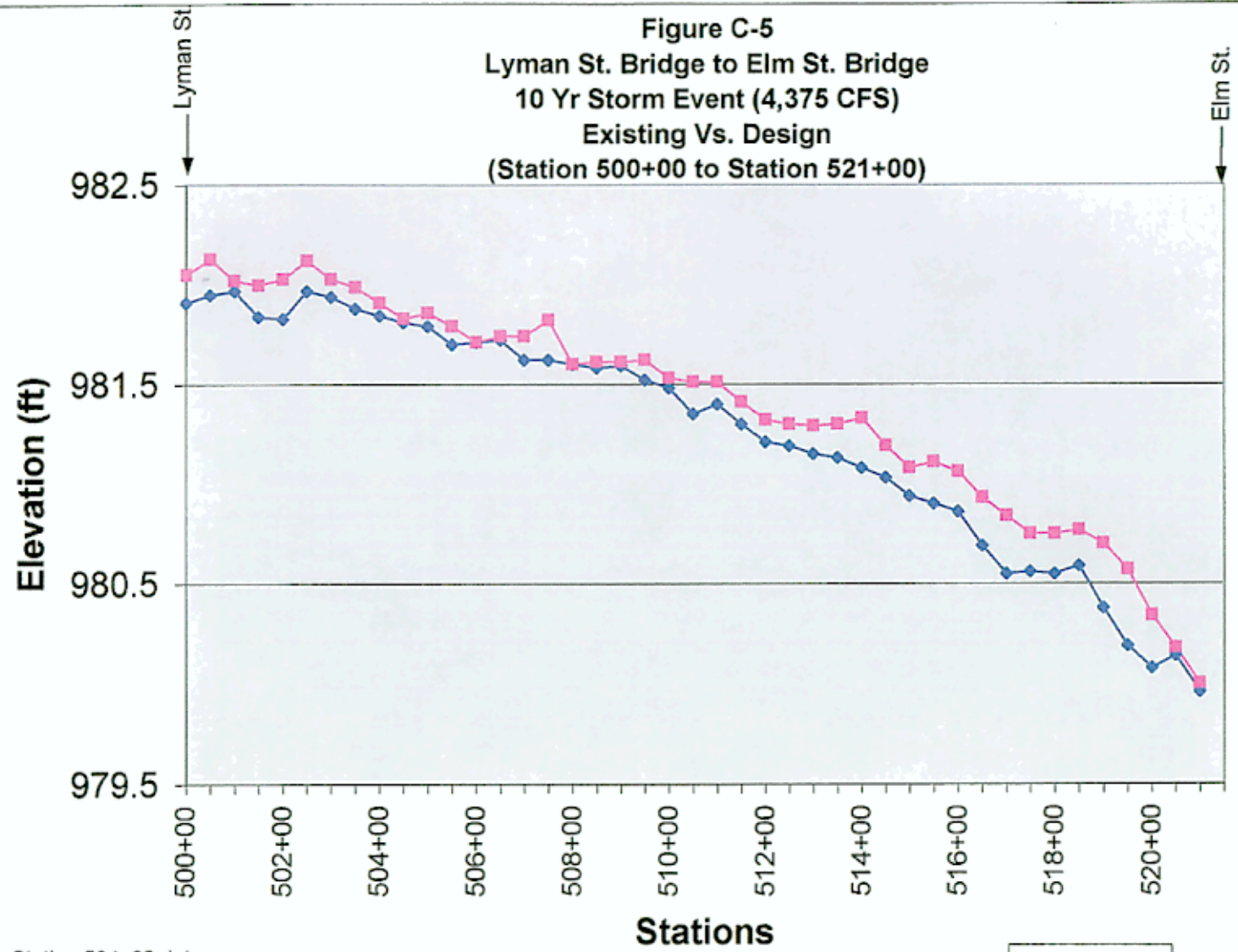


Note: Station 504+00 data  
interpolated between 503+50 and  
504+50 due to drainage ditch

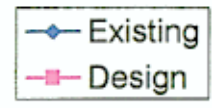




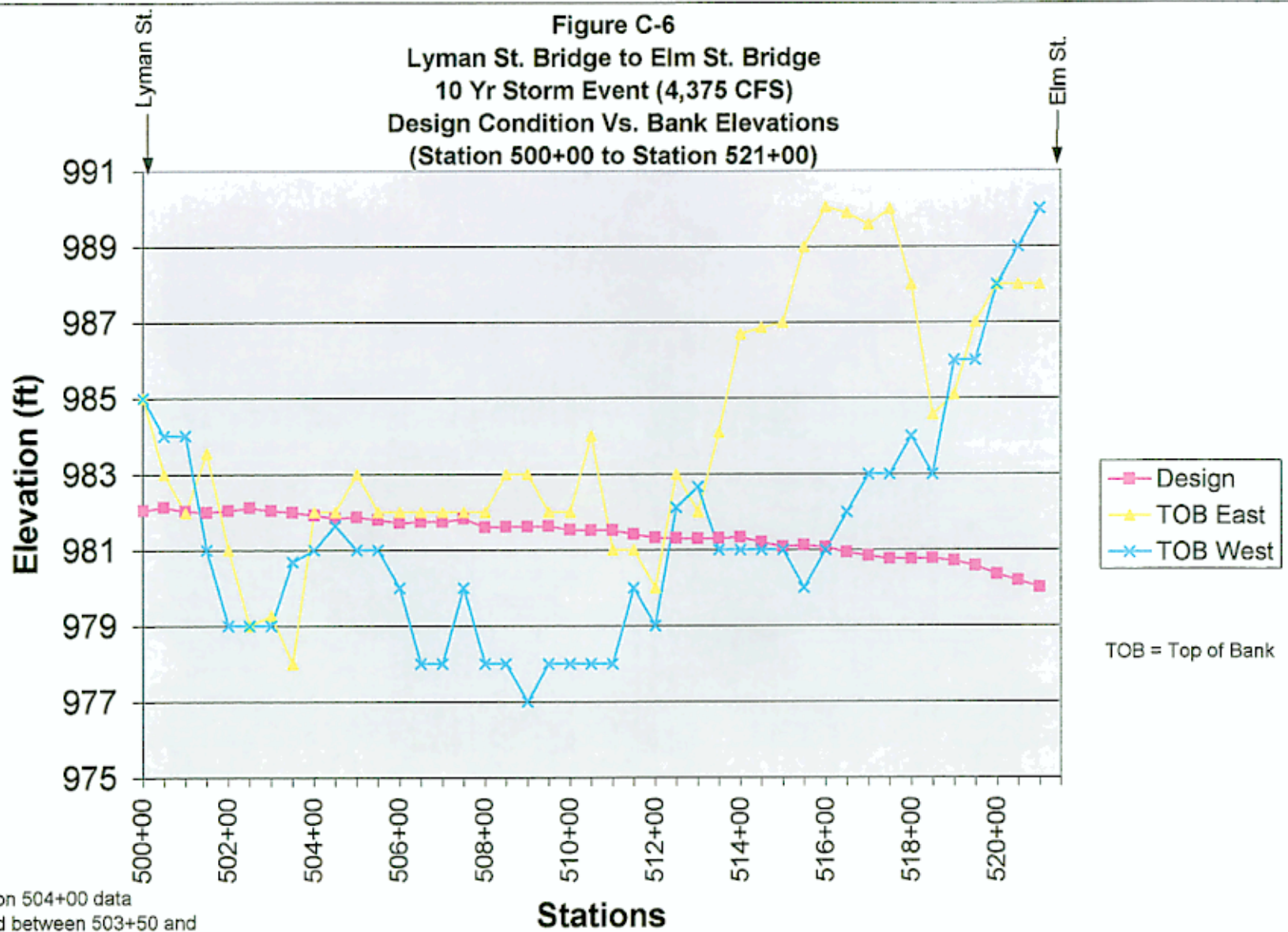
Note: Station 504+00 data  
interpolated between 503+50 and  
504+50 due to drainage ditch



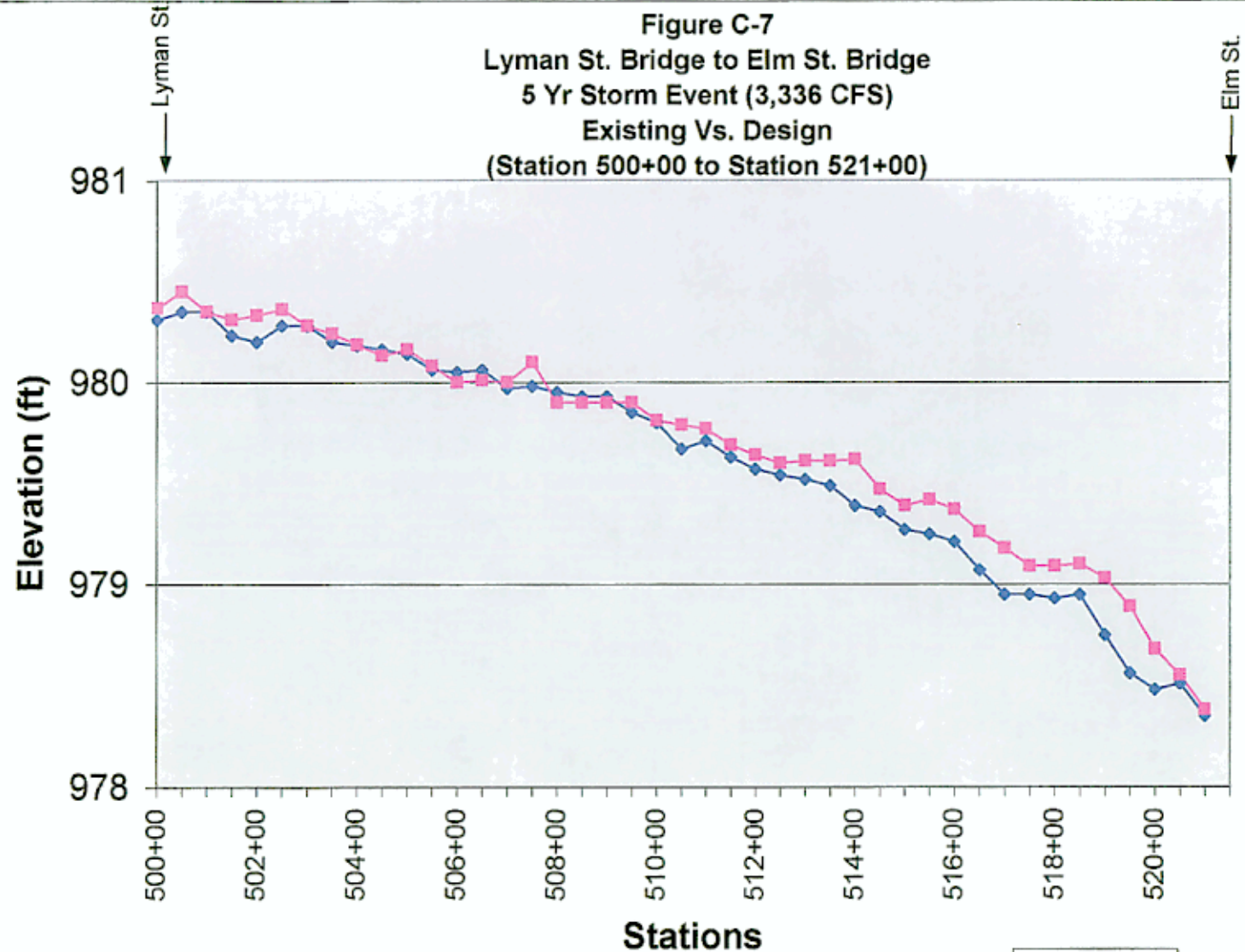
Note: Station 504+00 data interpolated between 503+50 and 504+50 due to drainage ditch



**Figure C-6**  
**Lyman St. Bridge to Elm St. Bridge**  
**10 Yr Storm Event (4,375 CFS)**  
**Design Condition Vs. Bank Elevations**  
**(Station 500+00 to Station 521+00)**



Note: Station 504+00 data interpolated between 503+50 and 504+50 due to drainage ditch

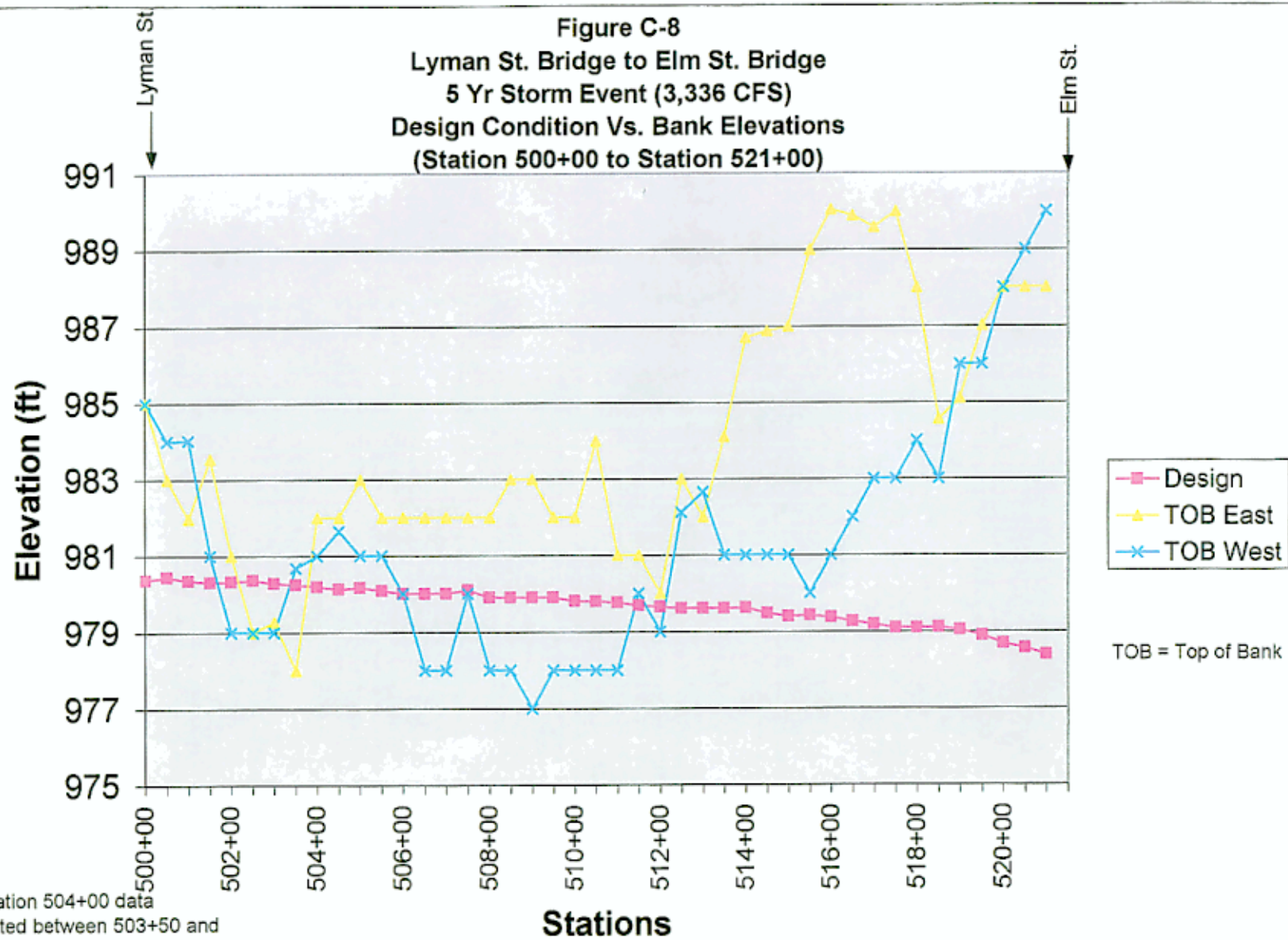


Note: Station 504+00 data  
interpolated between 503+50 and  
504+50 due to drainage ditch

Existing  
Design



**Figure C-8**  
**Lyman St. Bridge to Elm St. Bridge**  
**5 Yr Storm Event (3,336 CFS)**  
**Design Condition Vs. Bank Elevations**  
**(Station 500+00 to Station 521+00)**



Note: Station 504+00 data interpolated between 503+50 and 504+50 due to drainage ditch